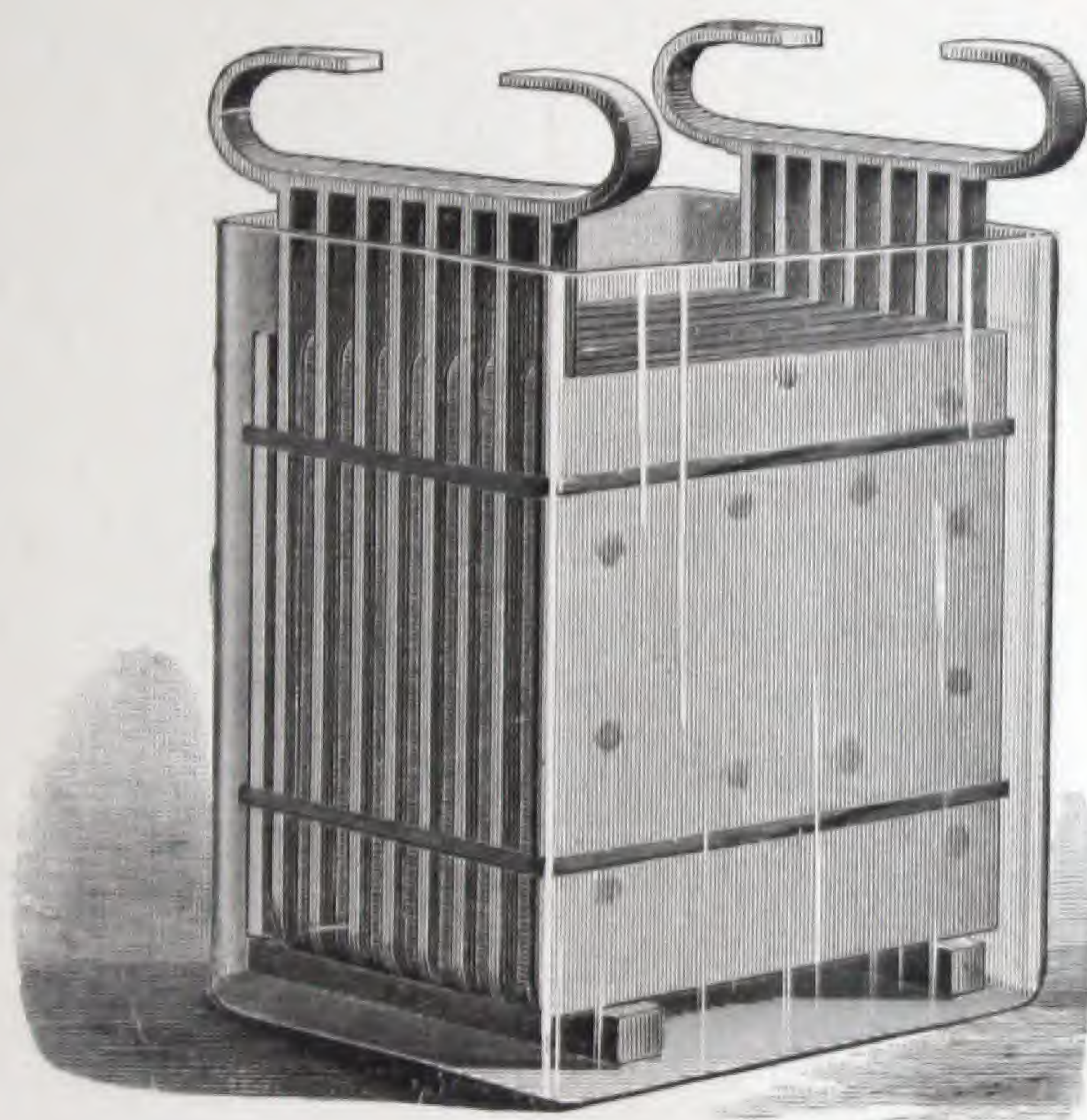


THE ELECTRO DYNAMIC CO.  
OF PHILADELPHIA,  
224 CARTER ST.,  
LICENSEES.

THE

# ELECTRICAL ACCUMULATOR

COMPANY,



No. 44 BROADWAY,

NEW YORK CITY.





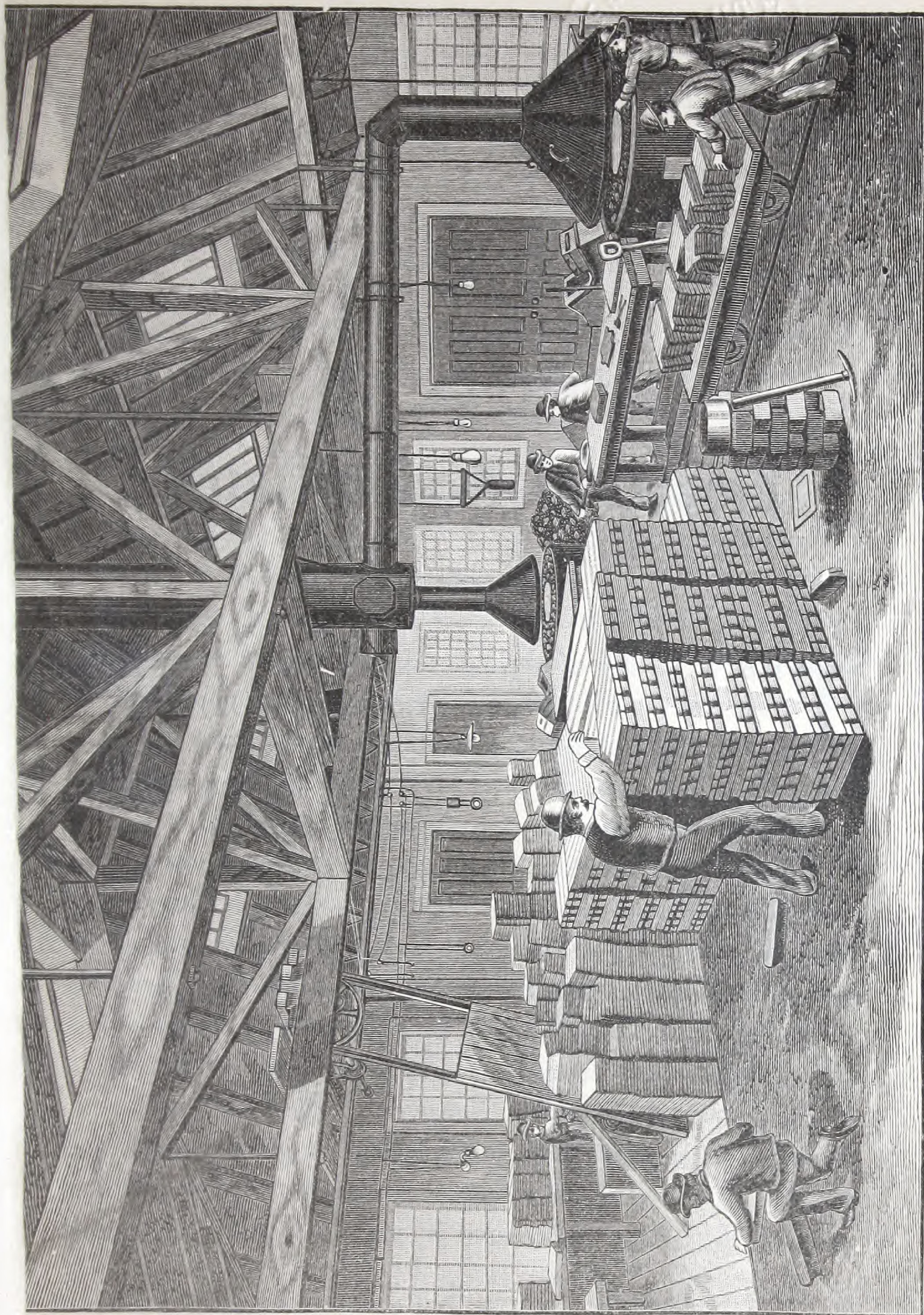
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WORKS OF THE ELECTRICAL ACCUMULATOR COMPANY—FOUNDRY.



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## HISTORY OF THE **Electrical Accumulator.**

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**T**HE possibility of storing electricity was first suggested in 1801, by Gautherot's discovery that two plates of the same metal immersed in acid, after having been subjected to the action of an electric current in one direction, would produce a secondary current in the opposite direction.

In 1859 Gaston Planté, while engaged in a series of experiments upon this phenomenon, devised a storage battery consisting of plates of lead immersed in dilute sulphuric acid. This, from a scientific standpoint, was a success, and when properly manipulated would yield a high and steady electro-motive force and currents of any desired strength according to the dimensions of the plates. On account, however, of the large surface required to be exposed to chemical action, its great weight, and the fact that months of electrical treatment were required to prepare the plates to receive a charge of any considerable



## The Electrical Accumulator Company.

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magnitude, the Planté battery was not available for commercial use.

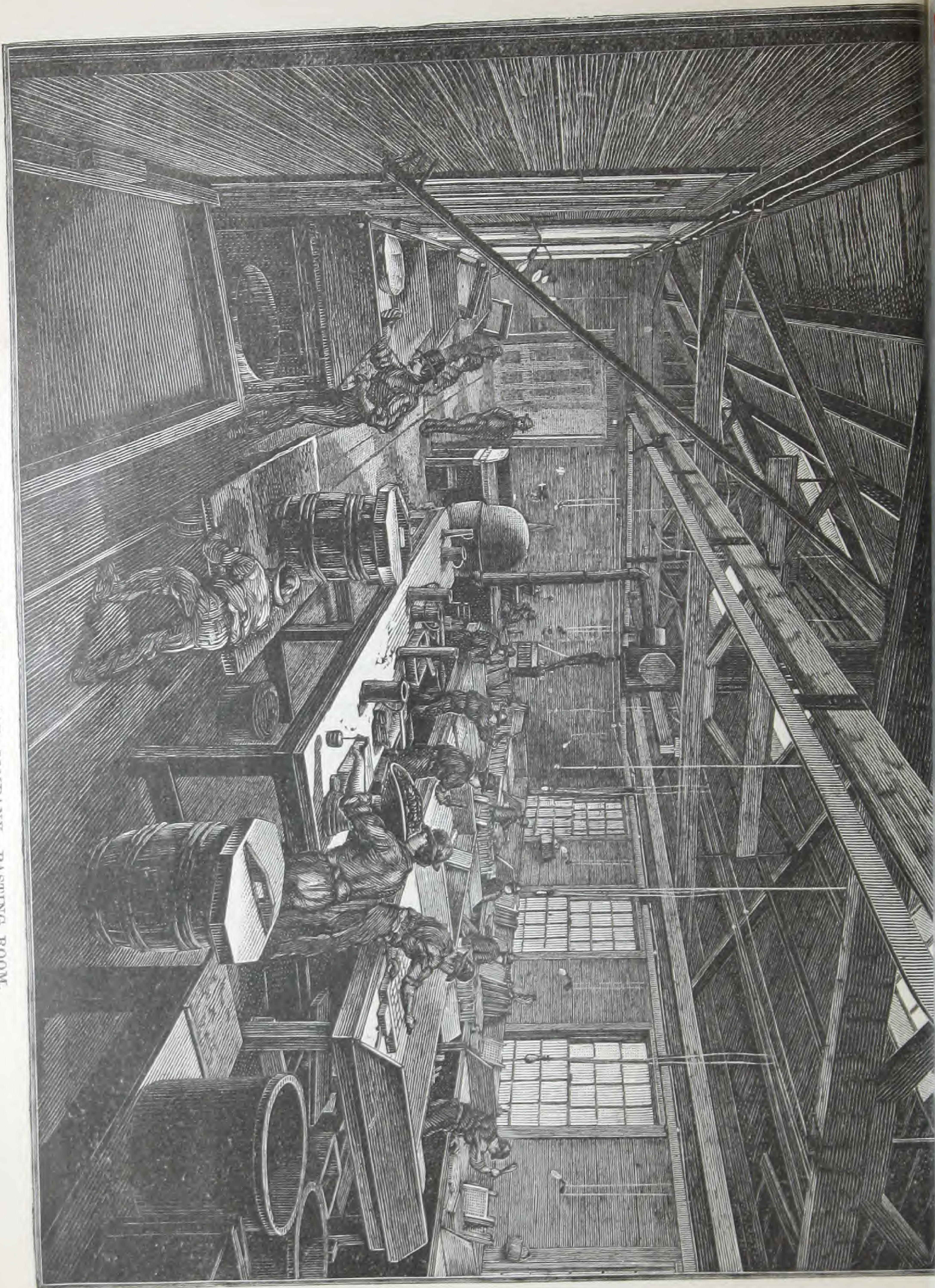
Camille A. Faure, after many experiments in this field, made the remarkable discovery that a paste of oxide of lead mechanically applied to the plates, brought them instantly into the condition to receive a charge which was only accomplished by Planté after months of electrical treatment. Moreover, Faure's discovery materially increased the efficiency and capacity of the battery and reduced its size and weight. Imperfections, chiefly of a mechanical character, existed in Faure's battery which have been entirely overcome by the supplementary inventions of Messrs. Swan, Sellon, Volckmar, Shaw, and others.

Storage Batteries, combining the invention of Faure with improvements thereon, are offered to the public by **The Electrical Accumulator Company**, *the owner of all the valid and valuable patents for Accumulators in this country.*

These Storage Batteries, improved upon from time to time, have been in use in England for several years, where the business was first developed under the auspices of THE ELECTRICAL POWER STORAGE COMPANY, Limited, of London, and their economy and reliability are demonstrated by the large and growing demand for them, both in America and abroad.



WORKS OF THE ELECTRICAL ACCUMULATOR COMPANY—PASTING ROOM,





## **Practical Applications of Accumulators.**

Storage Batteries, or Accumulators, as they are called, are available for all purposes to which electricity can be applied, such as

ELECTRIC LIGHTING,

[ARC AND INCANDESCENT,]

RAILWAY TRAIN LIGHTING,

STATIONARY AND LOCOMOTIVE POWER,

ELECTRO-DEPOSITION OF METALS,

TELEGRAPHY,

MEDICAL AND SURGICAL PURPOSES,

GENERAL LABORATORY USE,

ETC., ETC.

The storage of electrical energy by means of Storage Batteries of Electrical Accumulators, has made the use of electricity possible in many instances where hitherto it seemed impracticable, and in others has made such use an economy where before it was an extravagance. To-day many offices, private houses and towns are lighted, and many vehicles and motors are driven by means of the Accumulator system, under conditions which would not permit the use of electricity by the direct method. Under all circumstances, this system affords the the cheapest, steadiest and safest mode of lighting.

In localities where surplus power is available at odd times during the day, electricity may be stored by means of Accumulators, and utilized at pleasure.

The Accumulator thus enables electric light and electric



## The Electrical Accumulator Company.

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power to occupy fields in which direct systems cannot obtain a foothold, and when used as an auxiliary to the direct system increases the capacity of a given plant and lessens its running cost.

Water power situated at a distance from the point at which work is to be done may be successfully utilized by means of Accumulators, inasmuch as the power can be transformed into electrical energy by means of turbines and dynamos on the spot, and carried by wire to any desired point, and there stored in Accumulators for the subsequent production of light or power at will.

In the same general way, variable or intermittent power, such as windmills, or the line-shafting in machine shops, etc., may be availed of. The electricity thus irregularly produced would give a flickering light of varying intensity if used directly, but if stored in the Accumulator the pressure would be uniform and the lights, in consequence, perfectly steady during the period of their use. If the dynamo is driven by any such power without the use of Accumulators, variations of the light will ensue; but if the Accumulator is added to the system, no variation will occur, and the current will be delivered at an almost constant pressure, no matter how irregular the prime source of power.

In addition to these advantages, the Accumulator stores a supply of energy which is always on hand to tide over a breakdown, or to furnish light or power after ordinary working hours; and furthermore gives an absolutely steady current free from pulsation, which is a point of the greatest importance.



## **Electric Lighting.**

The main advantages which the electric light has over every other illuminant, viz: The safety which it offers from fire, the freedom from heat, smoke, and deleterious gases, its steadiness, the non-consumption of oxygen, and the facility with which the lights can be distributed, will always be strong arguments for its adoption.

Direct lighting, where the lamps are supplied directly from the dynamo, and are dependent on the regularity with which it runs, may be compared to a gas plant with no gasometer, the jets being fed directly from the retorts.

Accumulators reduce the running cost in large and small installations, and acting as a reservoir, make the failure of the light impossible under any circumstances.

## **Isolated Lighting.**

Before the introduction of Accumulators, private house lighting was entirely impracticable, except upon a very expensive scale, because it involved the services of an engineer, and the running of an engine and boiler during the hours of lighting. Moreover, an accident to the engine, boiler or dynamo would result in the extinction of the lights. With Accumulators, however, the work of running the dynamo can be done during the day, and in some cases the dynamo need be run only once a week; and the apparatus, instead of requiring the entire attention of a skilled engineer, may be managed with ease by a gardener or groom in the intervals of his other duties.



## The Electrical Accumulator Company.

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The lighting of offices, halls, churches, etc., by the direct system is far from being satisfactory, because it must be supplemented by the use of gas or oil on dark days, or in passage ways and secluded places during those portions of the day or night when the engine is not running.

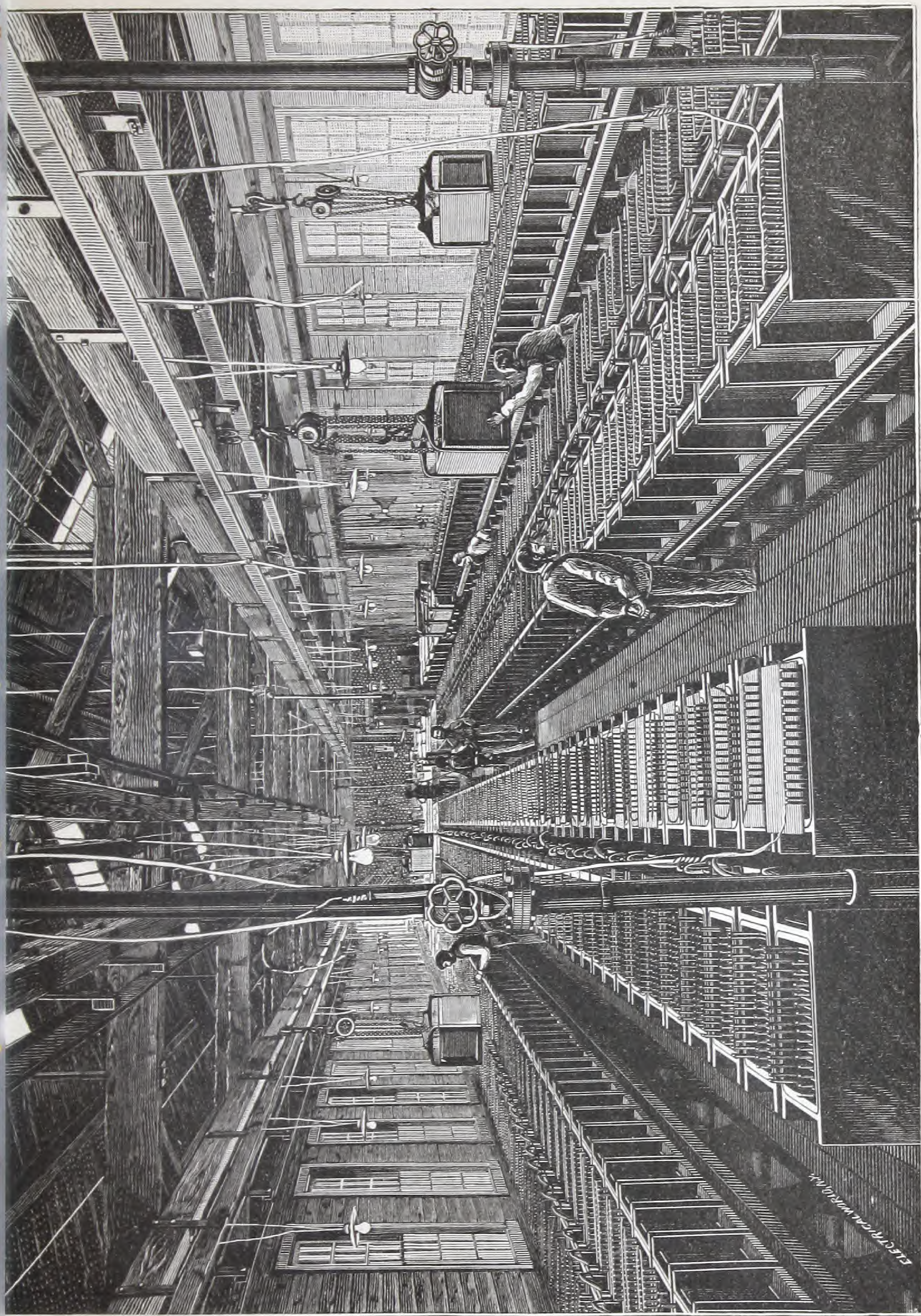
By adding Accumulators, however, the direct isolated system can be made absolutely complete, as the surplus energy stored during running hours can be utilized during the remaining hours of the day and night, and thus the ordinary mishaps incident to electric lighting, such as accidents to engine or dynamo, defects in machinery or failure in fuel or water supply, can also be provided against, and the required illumination be assured at all times.

### **Central Station Lighting.**

The use of Accumulators in connection with Central Station work offers many advantages over direct lighting, and furnishes the only safe and economical means of supplying lamps located at a considerable distance from the station, whether low tension systems or high tension methods with converters are used, which depend upon the uninterrupted running of machinery for the continuity of the lights.

1. The first cost for steam power is less.
2. The power used is in direct proportion to the lamp load, all surplus power not required being stored up in the Accumulators, for use when the dynamo is not running.
3. The Accumulators can be located so as to supply customers eight or ten miles from a central station.





WORKS OF THE ELECTRICAL ACCUMULATOR COMPANY—FORMING ROOM.



## The Electrical Accumulator Company.

4. The running expense of an Accumulator plant for a given number of lamps is less than that of a direct plant.

The first two of the following tables are published by one of the direct lighting companies:

### Amount and Cost of Power Required for a Plant of 5,000 Lamps of 16 Candle Power Each. 15 Lamps per Electrical Horse Power. Average Distance, 4,000 feet.

SYSTEMS.	POWER REQUIRED.	Approximate First Cost of Power, Including Engines, Boilers and Building.	Approximate Annual Cost of Power at \$30 per h. p.
Three-wire [direct] system, 12½% loss in main wire....	555 h. p.	\$27,750	\$16,650
Alternating [transformer] system, 2½% loss in main wire.....	555 h. p.	27,750	16,650
Accumulator system, 2½% loss in charging main.....	300 h. p.	15,000	9,000

The above tables are based upon a cost of twenty dollars per horse power for engines, fifteen dollars per horse power for boilers and fifteen dollars per horse power for buildings.

So far as regards first cost, the direct systems in use are more expensive than the Accumulator system, even on so small a scale as the 5,000-lamp station. In a larger station the difference is far more favorable to Accumulators.

The more important difference, however, is in the running expense. The annual expense of the three-wire system on the basis of \$30 per h. p. per annum, would amount to \$16,650,



### The Electrical Accumulator Company.

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with 12½ per cent. loss in the wire. The annual expense of the alternating system, on the same basis, would be the same, whereas for the Accumulator system the expense would be only \$9,000 or even less, because to meet the average requirements, both the direct and alternating systems must be operated during the entire twenty-four hours of the day, whereas by means of the Accumulator system the power need not be in use longer than—say twelve hours, or in many cases not more than eight or ten hours; the energy to supply the light required for the remainder of the twenty-four hours being stored up during the hours of running.

Another economy is in the saving of lamps, the life of which is increased very greatly, owing to the fact that there is no fluctuation in the current.

The producer can, therefore, supply the consumer with light at a price considerably less than the present charges of the direct lighting systems, or, if those charges be maintained [and with the absolutely uniform light supplied by the Accumulator they may be] then the gross revenue from a given outlay may be largely increased and the net returns can be increased in even greater ratio. In a word, in order to reap the full advantages of electricity as an economical mode of lighting, it is absolutely necessary to use the Accumulator system, because the demand for light is a very fluctuating one, the maximum supply being required for only two or three hours during the day, a very small consumption going on during the rest of the time. Generally, the most economical method of using Accumulators, is to install enough of them for one-half of the lights, depend-

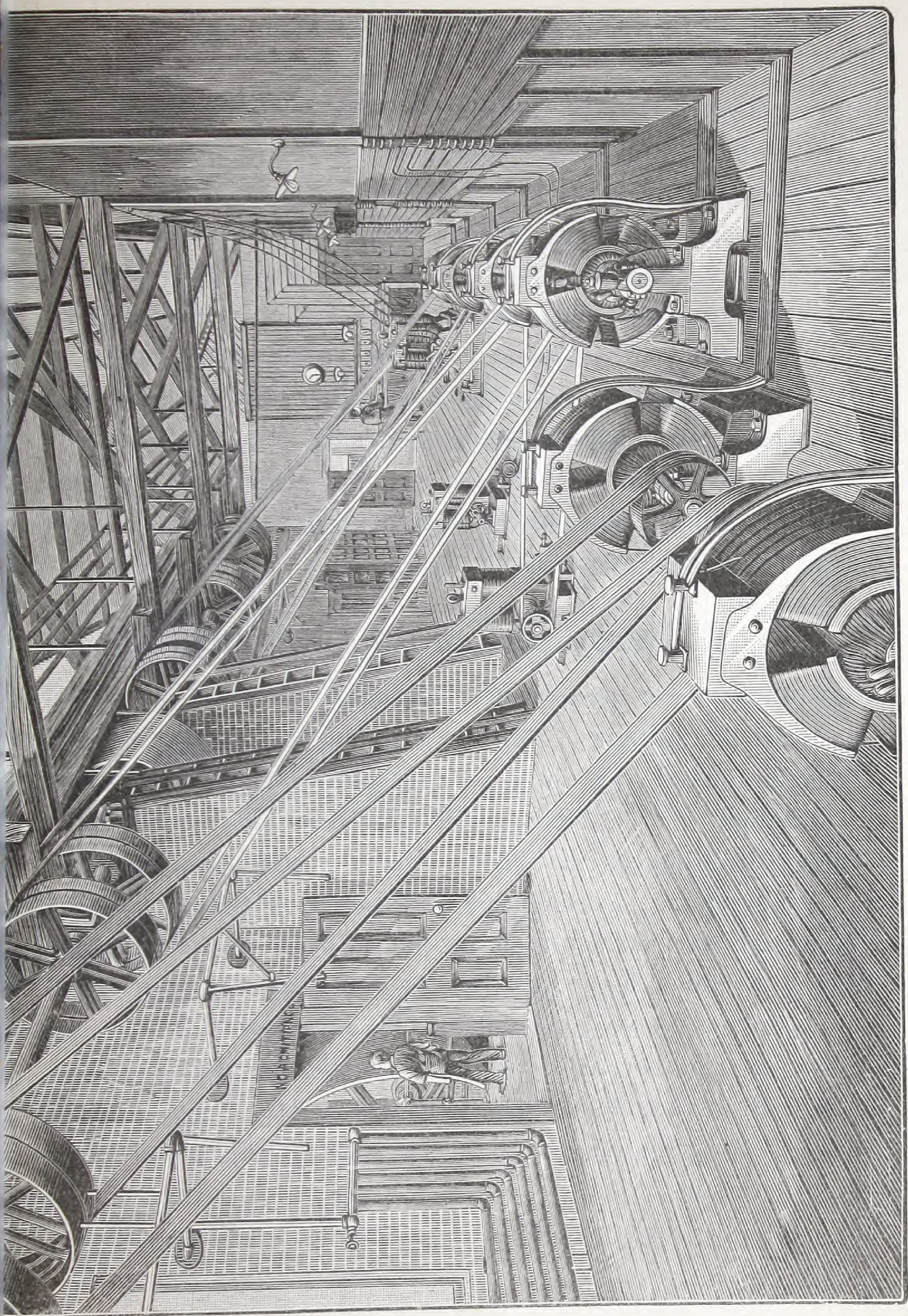


ing upon the engines and dynamos for the other half. In this way the Accumulators may be stored during the hours of lightest consumption, and used to supplement the engines during the hours of heaviest consumption, and the engines may be run at their full load, and, therefore, under the most economical conditions, for such time as may be necessary; whereas, with the alternating and other direct systems, it is necessary to keep the engines running even when the load is only one-half or one-tenth of a horse power, involving an enormous loss of power when the demand is light. In one case, with the direct system, it has happened that as much as ten horse power has been required to maintain a single incandescent lamp of 16 c. p., whereas that amount of power, it is well known, is capable of supplying a maximum of one hundred lamps during the time of running, and if applied to the work of storage, would supply electricity for eighty or ninety lamps for a total period of time equal to that during which the engine is running, and this time could be divided up among the lamps as they are needed.

It will thus be evident that on the one hand the direct systems are reasonably economical only during the hours of heavy consumption, and are extravagantly wasteful during the hours of moderate demand for light, while on the other hand, the Accumulator system will enable the light to be produced at an economical rate, whether the demand be heavy or light. Where triple expansion engines and a high class of boilers are used, ten 16 c. p. lamps per indicated horse power can be produced for one hour by the consumption of two pounds of coal.

These lamps are equivalent to five-foot gas burners, and as





WORKS OF THE ELECTRICAL ACCUMULATOR COMPANY—DYNAMO ROOM.



two pounds of coal used in this way to produce electricity will give an equivalent in light to fifty cubic feet of gas, a ton of coal will, of course, produce the equivalent of 56,000 cubic feet of gas, about six times as much light as could be produced from a ton of coal distilled in the best manner for the production of illuminating gas. On a fair scale the cost of an electric plant would be about equal to the cost of a gas plant, and the running cost would be about proportional to the coal consumption; therefore, the cost of producing electricity on an equal scale becomes, with the Accumulator system, considerably less than the cost of producing gas, while the character of the electric light is far superior to that of gas.

### **Railway and Ship Lighting.**

During the past year remarkable progress has been made in the lighting of Railway cars, and of the many systems tried by the railroads, the most satisfactory is the Accumulator. The weight of a battery of Accumulators for an all-night car is about the same as that of the usual gas apparatus, say 1,000 or 1,500 pounds, according to the number of lamps. The batteries may be charged either on the car by means of a dynamo driven by the axle, or by a small engine supplied with steam from the locomotive, or by any other motor, or they may be charged at the terminal stations of the line, as may best suit the circumstances of the case; the latter method involves the use of two or three sets of batteries which must be shifted at each terminus.

The lighting of yachts and passenger ships by electricity,



## The Electrical Accumulator Company.

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has been successfully accomplished only by the aid of the Accumulator, because it has been found impossible to keep the high-speed machinery incidental to electric lighting, in such perfect order on ship board as to give no trouble during the voyage. The battery is necessary, if for no other purpose, as a regulator. Few people have crossed the Atlantic for the past few years without experiencing the disagreeable features of the electric light which frequently flickers or even goes out. These objections are never obviated entirely, except by the use of Accumulators.

Another great advantage of the Accumulator when used for lighting vessels, yachts, railway cars, etc., lies in the fact that by charging the cells during the daytime, the continual noise produced by the dynamo, which necessarily runs at high speed, may be avoided during the hours devoted to sleep and rest.

### **Propelling Street Cars.**

The propulsion of street cars is another interesting application of Accumulators, and it is thought that the abolition of the use of horses will effect a considerable saving in the running of the street car systems of this country and do away with the many evils incident to their use. By the use of Accumulators, the cars are propelled noiselessly, stopped and started without shock, are absolutely independent of each other, do not contribute to the filth of the streets and are more perfectly under control than when drawn by horses.

In most cities and towns the overhead electrical systems



are wholly impracticable, because of the unsightly appearance of the double line of poles to support the wires over which the trolleys run, while the underground conductor is very costly, so that to Street Car Companies desiring to use electricity as a motive power, the Accumulator furnishes a simple, economical and effective means of attaining their object. One car or more may be equipped for trial. The expense of maintaining one car, however, will not be a fair criterion of the economy of the Accumulator system, although the car will demonstrate the practicability of this method of propulsion. Like all other new things, Accumulators must be introduced on a sufficient scale to be considered beyond the nature of experiment. This has been demonstrated in the matter of car lighting. When only one car was lighted, the Accumulators were in everybody's way, and it was nobody's business to take care of them; but now that railroad companies are going into electric train lighting on a large scale, fitting up whole trains, installing their own dynamos, and creating electrical departments in their respective staffs, the economy and advantage of the Storage system are shown to be exactly what is claimed for them.

## **Deposition of Metals.**

The deposition of metals by the use of electricity is another useful application of Accumulators; metals are deposited more uniformly, more cheaply and with less attention than by the older methods. The work can proceed at night without any supervision, often saving valuable time.



## **The Electrical Accumulator Company.**

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The durability of Accumulators has been the subject of much investigation, and it is believed that 10 per cent. per annum will be a fair allowance for the maintenance of them, if attended to by the owner. This expense can be reduced by careful use and by a determination on the part of the man in charge, not to allow the demand on the Accumulators to exceed their capacity. It is thought that in some cases, such as Central Station lighting, where the Accumulators are under the care of skilled owners, the cost of maintenance will not exceed 5 per cent.

This Company is prepared to maintain its Accumulators in good order, upon the annual payment of an agreed percentage of the cost, varying with the use to which the Accumulators are put, provided that its instructions are carried out in the installation and operation.

Experience has taught that the form of guarantee above mentioned which has no limitation as to time, is much more acceptable to our customers than the usual guarantee of one or two years; and we have therefore abandoned the old form and adopted this one in its stead.

### **Types of Accumulators.**

One of the standard types of Cell manufactured by this Company is known as the "15 A" and is made up of fifteen plates, eight negatives and seven positives.

This Cell is especially adapted to Isolated and Central Station lighting.



## The Electrical Accumulator Company.

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The general appearance of the Cell is shown by the engraving on the cover.

The electro-motive force of the cell is about 2 volts.

The internal resistance is extremely low, say from .001 to .005 Ohm, and the range of the current large.

The capacity of the cell in perfect condition is somewhat underestimated at 300 Ampere-hours; 30 Amperes, a safe working current, will last for over ten hours, with not exceeding 10 per cent. drop in electro-motive force, or a less current will be supplied by the cell for a proportionately greater number of hours. A greater rate—up to 300 Amperes—could also be obtained, but so great a strain upon this size of cell would injure the plates. (*See table of capacities and working rates, page 64.*)

From the data given, the number of cells required for any class of electrical work can be determined, when the requirements in volts and amperes and time are known.

To calculate the number of cells necessary for a given number of lamps, or for any given purpose, it is necessary to know, first the amount of current required, whether for lamps or for other purposes, and the electro-motive force required, also the number of hours for which the current must be supplied. The accompanying table of capacity, rate of charge and discharge of each type of cell, together with the known fact that the electro-motive force of each cell is about two volts, will enable anyone to calculate the number of cells and the type best suited to his purpose. For example, the "15 A" cells will produce 30 amperes for ten hours, say 300 ampere-hours.



## The Electrical Accumulator Company.

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If 100-volt lamps requiring a current of one-half ampere each are used, 50 "15 A" cells in series, after being fully charged, will supply 40 lamps for 15 hours, or 60 lamps for 10 hours, or 80 lamps for 6 hours; 80 lamps being the maximum load for one series. To supply 100 lamps requiring 50 amperes, it will therefore require two series of "15 A" cells in multiple, and as 100 volts require 50 cells in series, the installation will call for 100 cells of "15 A" type. If it be necessary to keep the candle power fully up to standard during the entire time of discharge, additional cells to the extent of 10 per cent. must be provided.

At this rate of discharge (25 amperes per cell), the battery of 110 cells will maintain 100 half-ampere lamps for 12 hours or a less number for a proportionately longer time.

Similarly, if 60-volt lamps requiring, say eighty-four hundredths ampere each, are used, 33 cells of the "15 A" type will supply 40 lamps for about nine hours or a less number for a proportionately longer time.

Adding to the number of cells in multiple arc, increases the available number of amperes, but does not increase the electro-motive force; on the other hand, adding to the number of cells in series does not increase the number of amperes, but simply increases the electro-motive force,

In estimating the power of engine required to charge the battery, allow about one-tenth indicated horse power per cell of the "15 A" type or the "23 C" type. For the case above referred to, a ten-horse power engine would be required. It should be remembered, that such a plant, however, would suf-



## **The Electrical Accumulator Company.**

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fice for 200 lamps if the engine were used to supplement the battery, as shown on page 12.

### **Estimates.**

Estimates for complete installations, etc., including all necessary apparatus, furnished upon application to

**THE ELECTRICAL ACCUMULATOR CO.,**

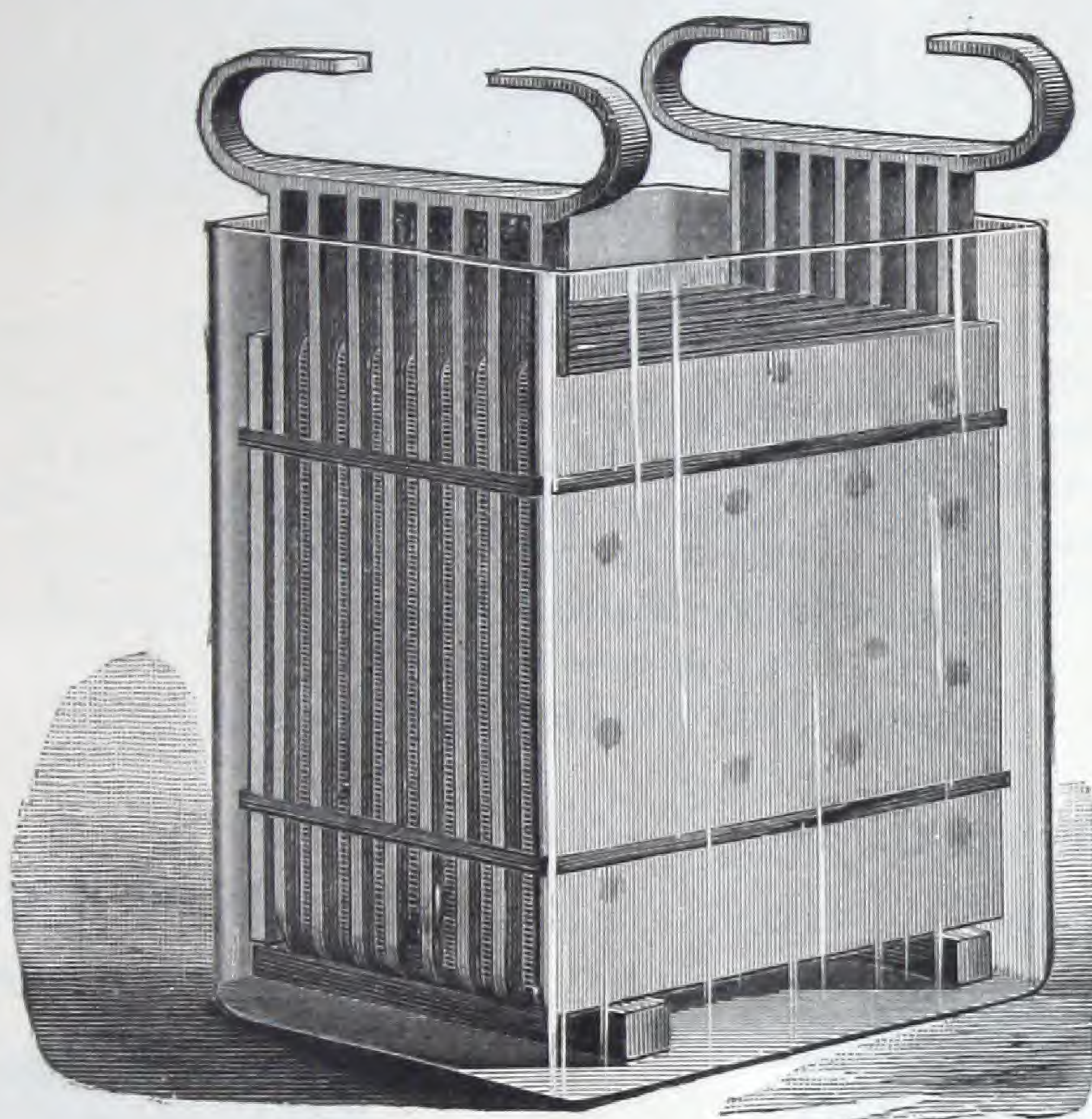
**44 Broadway, New York City.**



The Electrical Accumulator Company.

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TYPE 15 A.



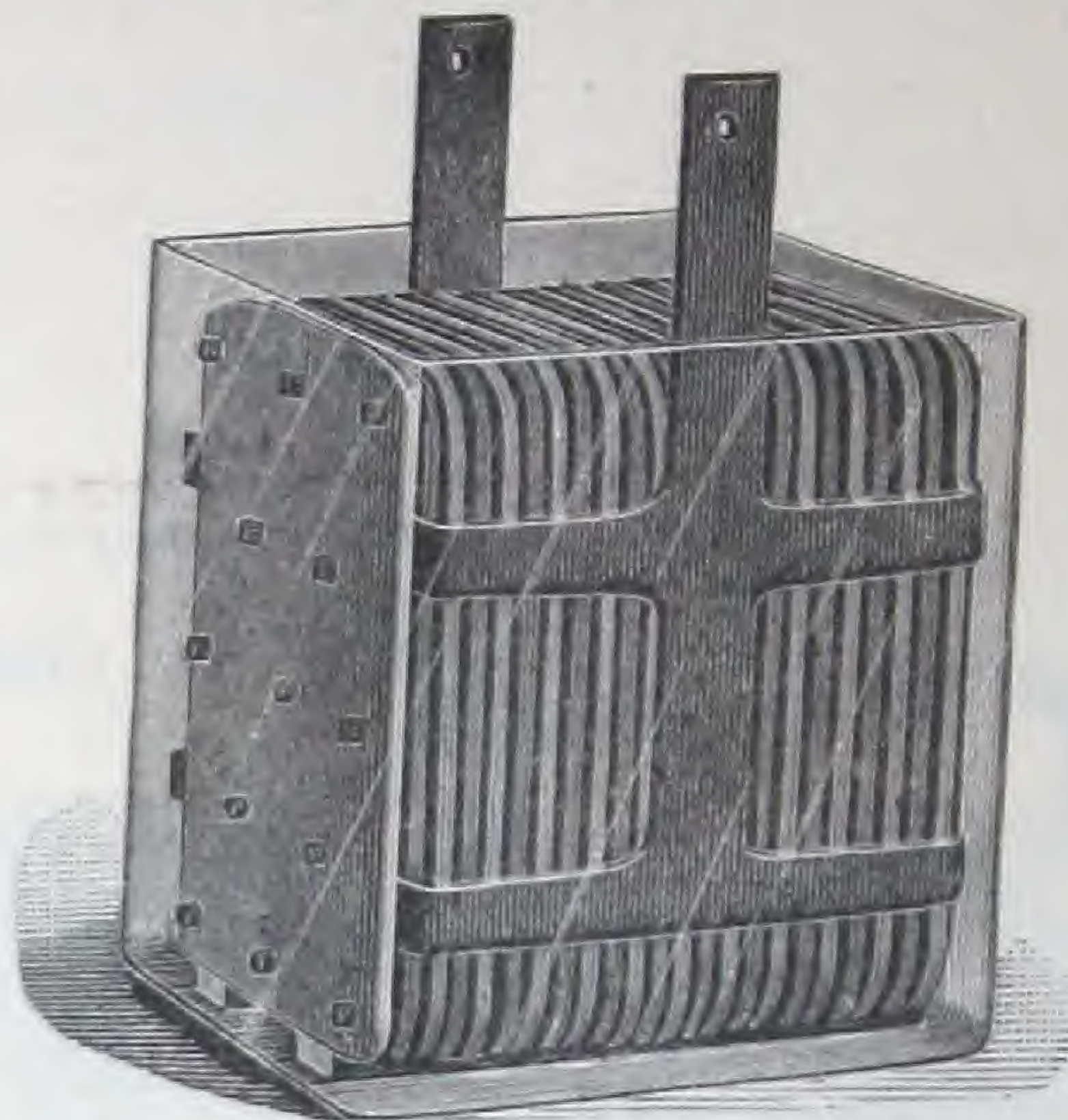
Floor space,  $9 \times 11\frac{1}{2}$  inches.  
Height, over all, 21 inches.  
Weight, 121 pounds.  
Electro-Motive Force, 2 Volts.  
Current, 30 Amperes.  
Capacity, 300 Ampere Hours.



The Electrical Accumulator Company.

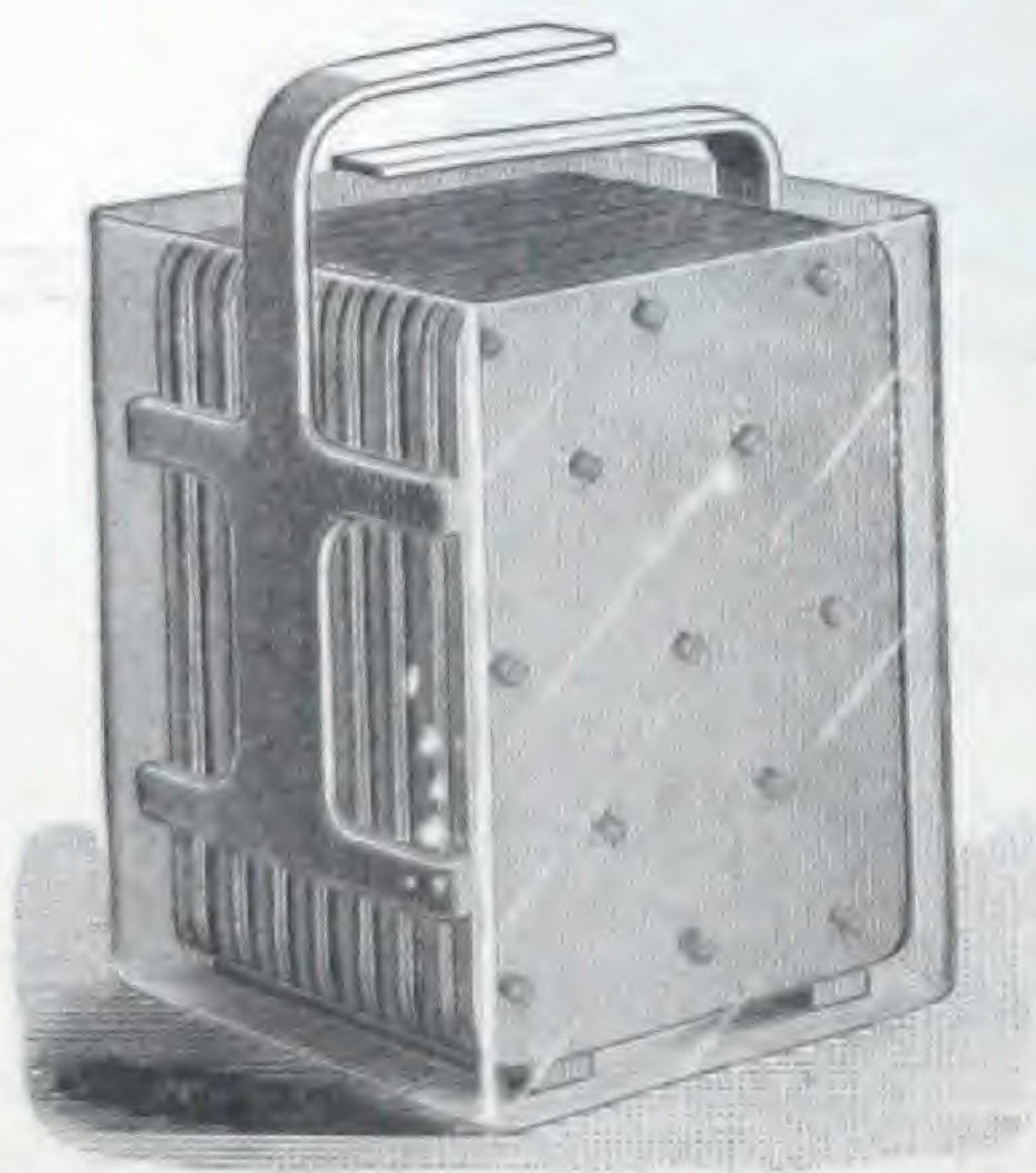
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TYPE 23 C.



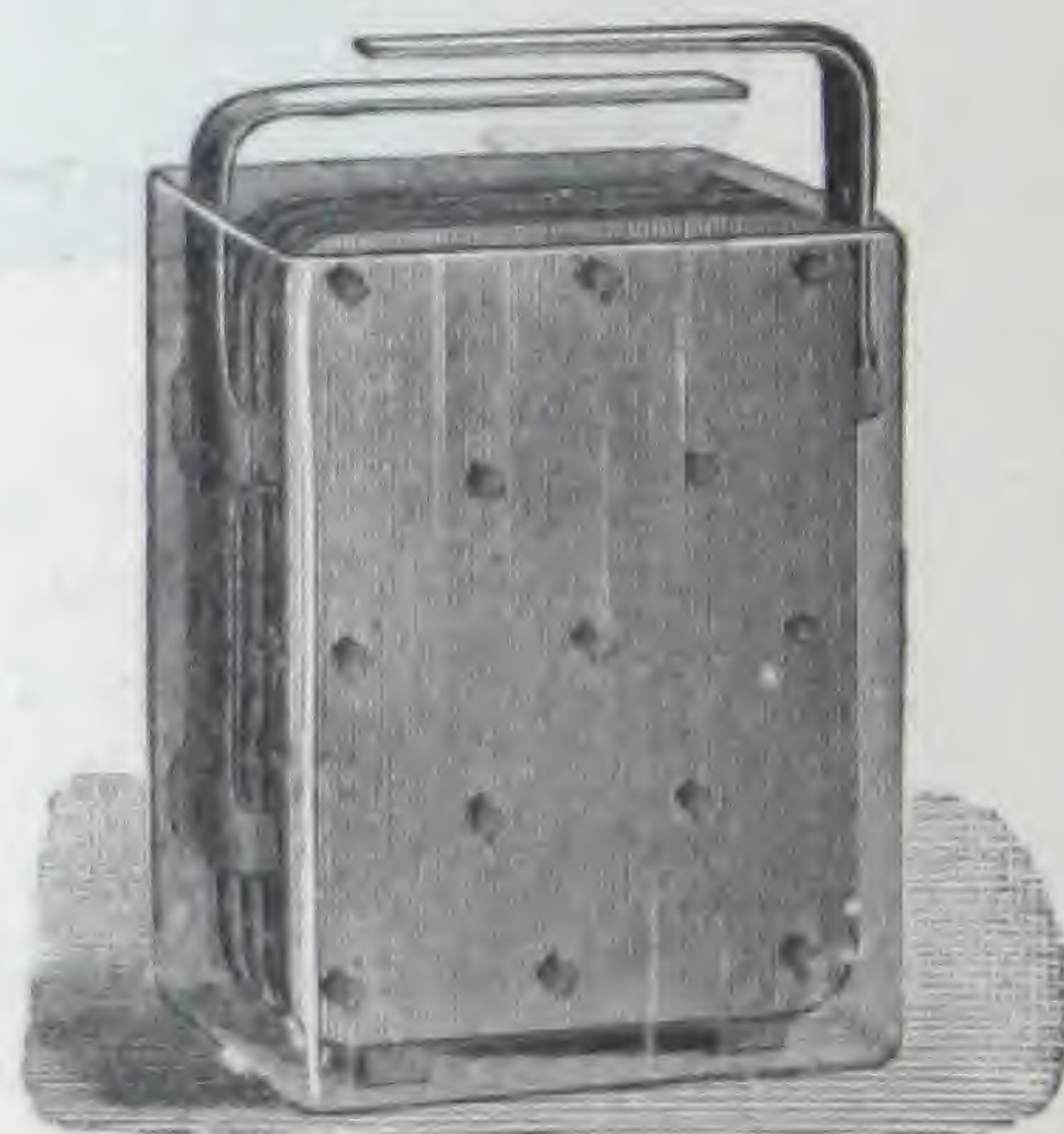
Floor Space,  $8 \times 8\frac{1}{4}$  inches.  
Height, over all,  $13\frac{3}{4}$  inches.  
Weight, in glass jar,  $49\frac{3}{4}$  pounds, in rubber or fiberite jar,  $42\frac{3}{4}$  pounds.  
Electro-Motive Force, 2 Volts.  
Current, 25 Amperes Normal.  
Capacity, 100 Ampere Hours, Normal.

TYPE 15 C.



Floor Space,  $8 \times 5\frac{1}{8}$  inches.  
Height, over all,  $13\frac{1}{2}$  inches.  
Weight,  $34\frac{3}{4}$  pounds.  
Electro-Motive Force, 2 Volts.  
Current, 15 Amperes, Normal.  
Capacity, 100 Ampere Hours, Normal.

TYPE 7 C.

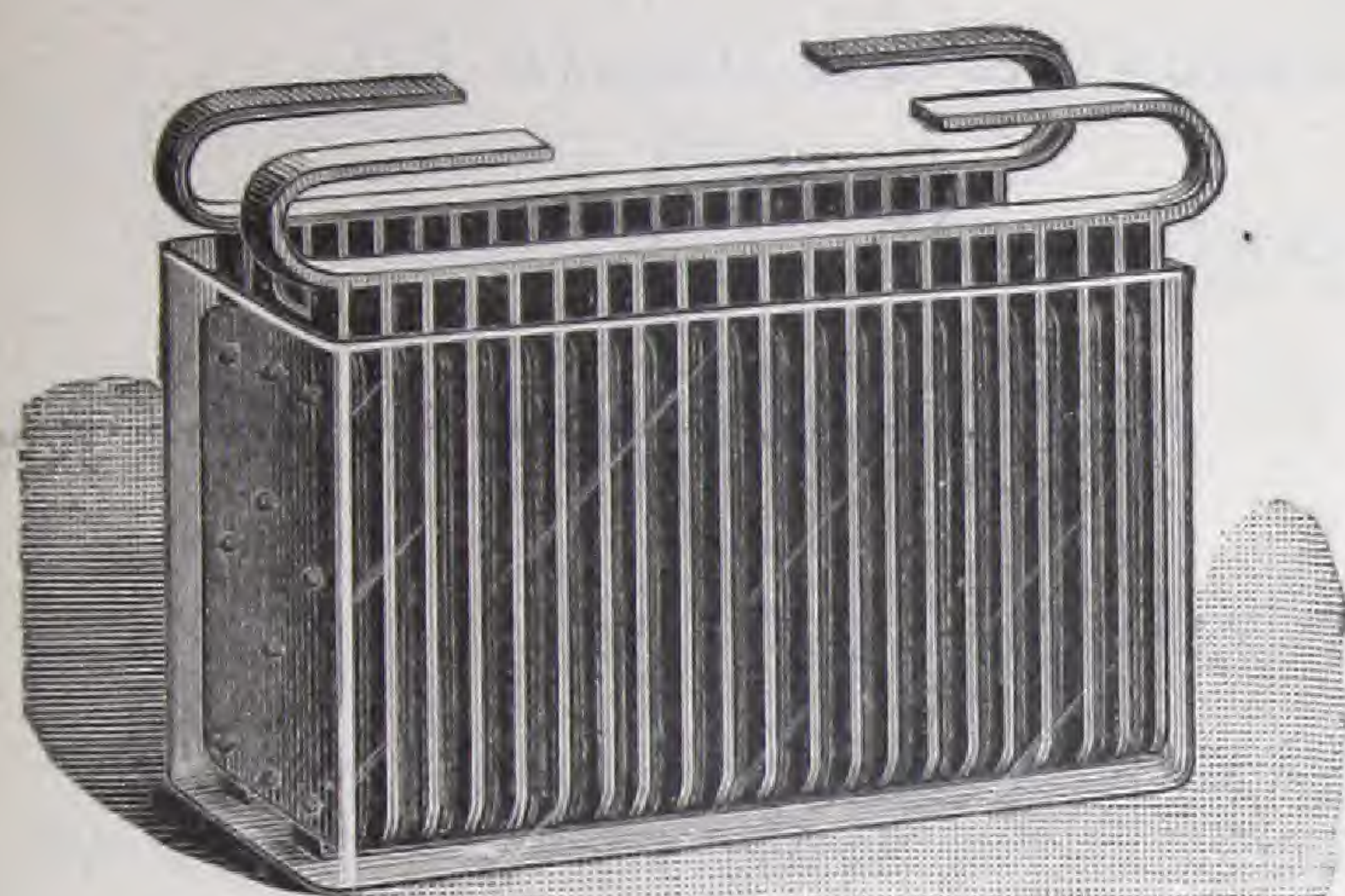


Floor Space,  $8 \times 3\frac{7}{8}$  inches.  
Height, over all,  $13\frac{1}{2}$  inches.  
Weight,  $19\frac{1}{4}$  pounds.  
Electro-Motive Force, 2 Volts.  
Current, 6 Amperes, Normal.  
Capacity, 45 Ampere Hours, Normal.



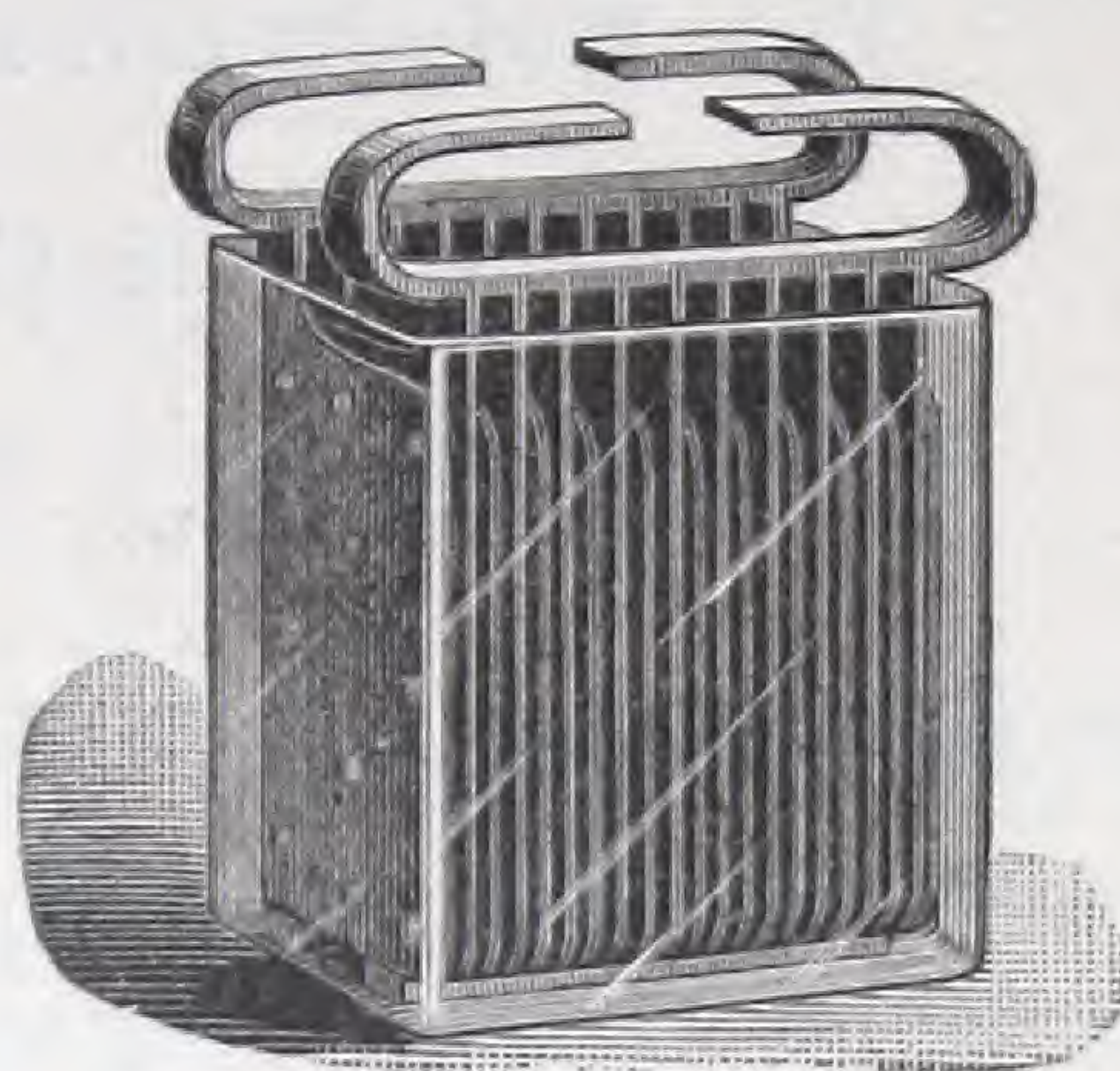
# The Electrical Accumulator Company.

## TYPE 41 D.



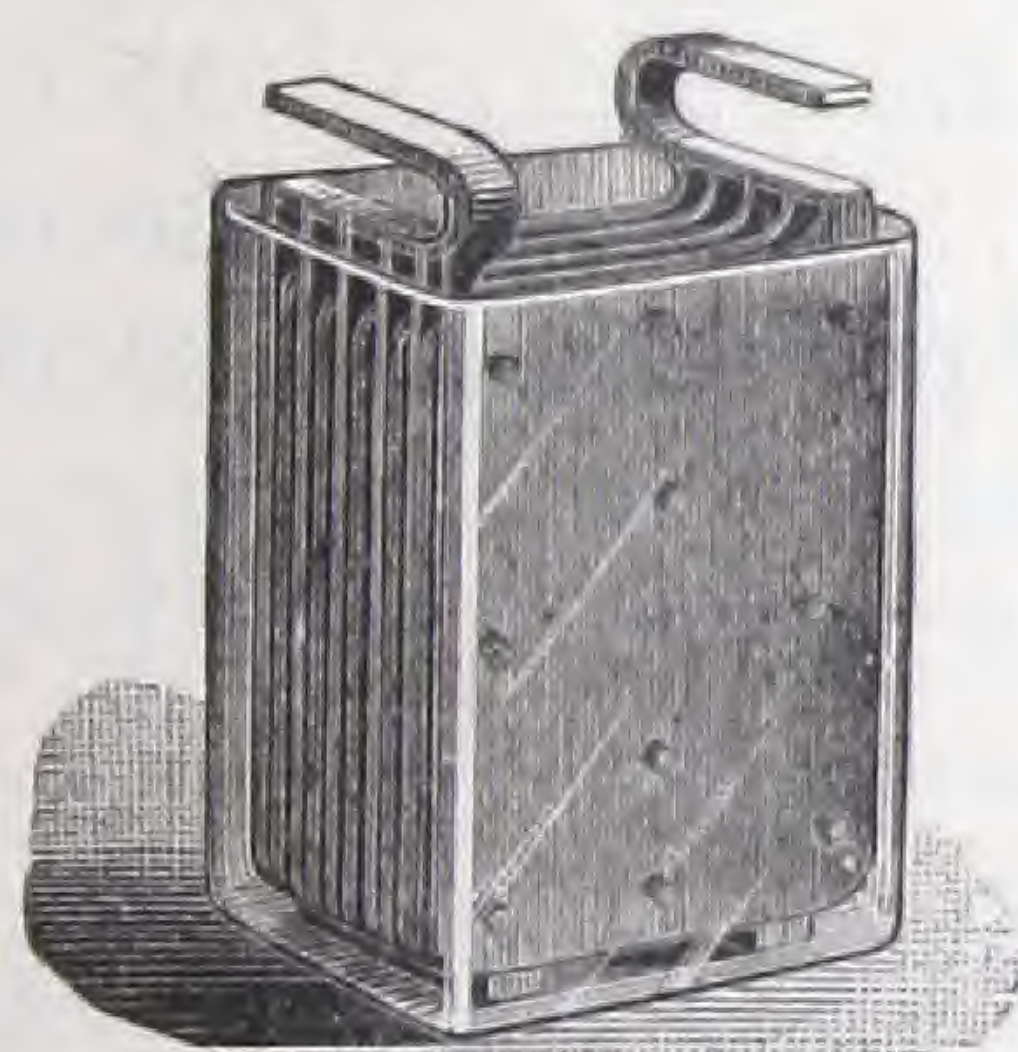
Floor Space  $5\frac{3}{8} \times 10\frac{5}{8}$  inches.  
 Height over all,  $10\frac{1}{4}$  inches.  
 Weight, 32 pounds.  
 Electro-Motive Force, 2 Volts.  
 Current, 20 Amperes, Normal.  
 Capacity, 90 Ampere Hours, Normal.

## TYPE 21 D.



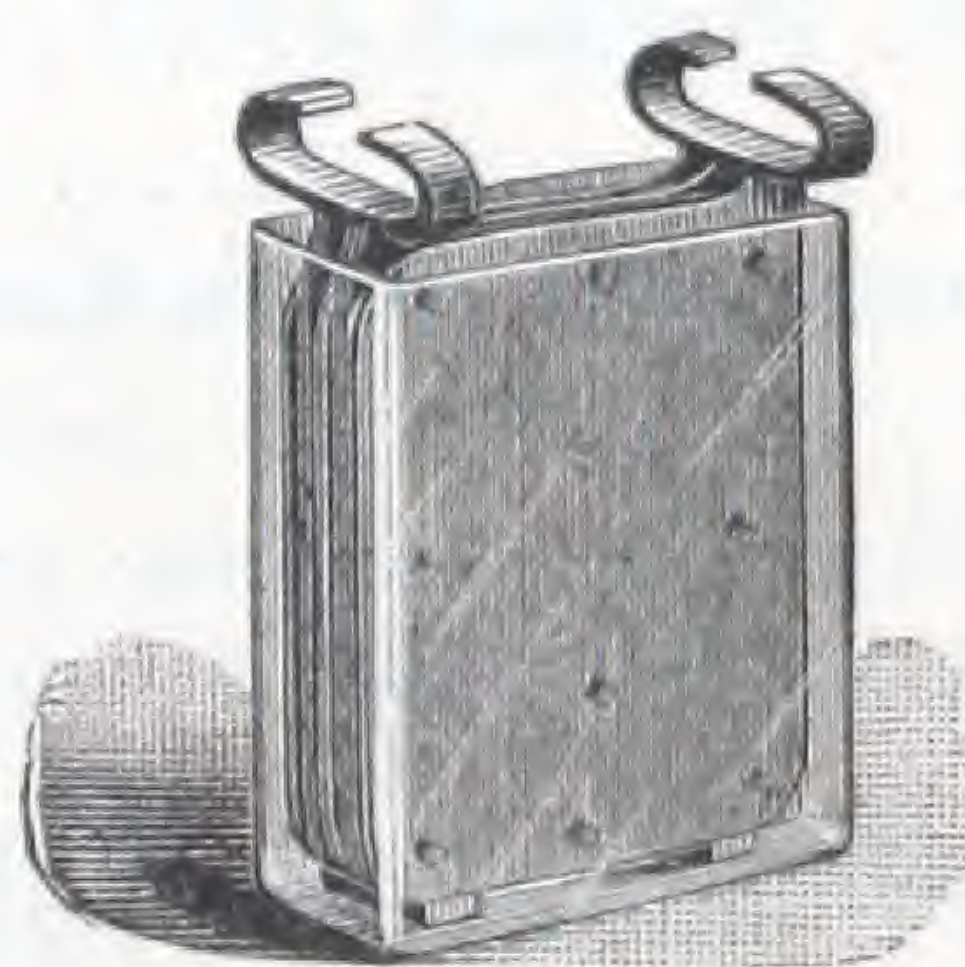
Floor Space,  $5\frac{3}{8} \times 6\frac{1}{16}$  inches.  
 Height, over all,  $10\frac{1}{2}$  inches.  
 Weight,  $16\frac{3}{4}$  pounds.  
 Electro-Motive Force, 2 Volts.  
 Current, 10 Amperes, Normal.  
 Capacity, 45 Ampere Hours, Normal.

## TYPE 11 D.



Floor Space,  $5\frac{1}{8} \times 3\frac{7}{16}$  inches.  
 Height, over all, 9 inches.  
 Weight,  $8\frac{1}{2}$  pounds.  
 Electro-Motive Force, 2 Volts.  
 Current, 5 Amperes, Normal.  
 Capacity, 23 Ampere Hours, Normal.

## TYPE 5 D.



Floor Space,  $5\frac{1}{8} \times 2\frac{1}{8}$  inches.  
 Height, over all,  $8\frac{1}{4}$  inches.  
 Weight,  $4\frac{1}{8}$  pounds.  
 Electro-Motive Force, 2 Volts.  
 Current, 2 Amperes, Normal.  
 Capacity, 9 Ampere Hours, Normal.



The Electrical Accumulator Company.

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GENERAL OFFICES OF  
THE METROPOLITAN TELEPHONE & TELEGRAPH Co.,  
18 CORTLANDT STREET,

NEW YORK, March 9th, 1888.

THE ELECTRICAL ACCUMULATOR Co.,  
44 BROADWAY, NEW YORK.

*Dear Sir :*

With reference to the 600 cells of The Electrical Accumulator Company's Storage Battery delivered to us for our building, No. 18 and 20 Cortlandt St., in the Spring of 1887, they continue to give entire satisfaction. We are burning 500 incandescent lamps of 16 candle-power (101 volt 0.7 ampere) giving us 80 per cent. efficiency from said battery with a perfectly steady and brilliant light.

This battery is charged comparatively without expense from an engine driving the dynamo that feeds the day circuit.

This battery is called upon to furnish current for the 500 lamps for twenty-six nights per month, and is credited with the following saving in running expense :

Night Engineer, salary per month.....	\$100.00
Night Fireman.....	55.00
Coal .....	166.50
Depreciation on Machinery per month, 10 per cent...	83.00
Total .....	\$404.50

or \$4,854.00 per year.

This Company is well pleased with the efficiency of the accumulators and the great saving in maintenance expenses, and I am arranging for a second storage battery room to place 300 more cells for operating Morse and Printing Telegraph Instruments.

Very respectfully,

(Signed) J. A. SEELY, *Electrician.*



The Electrical Accumulator Company.

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78 & 80 BROADWAY, ROOM 51,

NEW YORK, January 17th, 1888.

E. H. JOHNSON, Esq.,

PREST. EDISON ELECTRIC LIGHT CO.,

16 & 18 BROAD ST., NEW YORK CITY.

*Dear Sir :*

In reply to your inquiry of January 6th, we would state that the Electrical Accumulator system of lighting has been in use at 78 & 80 Broadway for about four years. It has done good service. So far as we can judge, it has more than paid enough for a safe sinking fund and a large interest on the investment. We are about to give orders for some changes and repairs.

Our plant at 44 Broadway has been equally satisfactory.

Yours truly,

NEW YORK IMPROVED REAL ESTATE CO.,

(Signed) S. L. PARRISH, *President.*

---

ALLENTOWN, PA., December 21st, 1887.

THE ELECTRICAL ACCUMULATOR COMPANY,

44 BROADWAY, NEW YORK CITY.

*Gentlemen :*

We take pleasure in stating that the Accumulators purchased from you some four months ago for Central Station Lighting purposes, have more than fulfilled our greatest expectations, and are a success in every particular. We purchased these accumulators only after making a thorough investigation of both direct and alternating systems. We are entirely satisfied with our investment.

Yours truly,

ALLENTOWN ELECTRIC LIGHT & POWER CO.

(Signed) W. A. RONEY, *President.*

A. H. BOWMAN, *Consulting Electrician.*



The Electrical Accumulator Company.

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HAVERFORD ELECTRIC LIGHT COMPANY,

HAVERFORD, PA., Nov. 3d, 1887.

ELECTRICAL ACCUMULATOR COMPANY,

44 BROADWAY, NEW YORK.

*Dear Sir :*

Mr. Griscom has referred to me your letter of November 1st, in regard to the Haverford Central Station Plant.

In reply I would say that I have given that plant considerable attention since the Electro-Dynamic Company has been running it and take pleasure in saying that you can refer applicants for Central Lighting Plants to the Electro-Dynamic Company for information, or we would be glad to take them out to Haverford and show them the plant in operation.

The batteries have been in active use for the most part since May 15th, and have done satisfactory service. No battery has been renewed in that time, and although individual cells have required some treatment, they are but few in number, and are all now in service. The batteries are in very good condition.

(Signed)

E. A. SCOTT, *Secretary.*

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CHESWOLD, HAVERFORD COLLEGE P. O.

MONTGOMERY Co., PA., July 1st, 1887.

W. W. GRISCOM,

PREST. ELECTRO-DYNAMIC Co.,

DEALERS IN ELECTRICAL ACCUMULATORS,

PHILADELPHIA, Pa.

*Dear Sir :*

The electric lighting plant which you put in for us has now been in regular use for more than six months ; I can therefore speak knowingly of its performance.

During all this time it has worked most satisfactorily. There has not been the slightest hitch or failure of any kind, and this notwithstanding the fact that I have given it no personal attention whatever, having left the whole management of the plant to our gardener, who has



## The Electrical Accumulator Company.

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no experience or knowledge that would fit him to take charge of the plant. He had to learn everything from your men.

The light has been a constant source of pleasure and comfort to us. Its absolute steadiness, its great convenience, the entire freedom from dirt or heat make it so far superior to any other light that any one having used this system of lighting would, I am sure, never abandon it.

I can safely say that if there is a single objection to the light, we have as yet failed to discover it.

As to the expense, I think that our light, after counting interest on the cost of the plant, fuel, maintenance and all expenses, will cost less than gas at Philadelphia prices.

Very truly yours,

(Signed)

A. J. CASSATT.

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THE BETHLEHEM ELECTRIC LIGHT Co.,

BETHLEHEM, PA., January 14th, 1888.

THE ELECTRICAL ACCUMULATOR COMPANY,

*Gentlemen :*

In reply to your favor asking information on Accumulator system would say, that we are getting most excellent results from our Central Station lighting. Our experience with accumulators is somewhat limited as we have used them only for the past six months. We are satisfied, however, that we have filled a long felt want, viz, an economical incandescent plant.

Our experience has taught us, that in the saving of running expenses is where the profits of electric lighting come in. Direct systems have always been unprofitable unless all lamps are in constant use during all running hours, and this we know is rarely the case. By the Accumulator system we put ourselves on the same basis as the gas companies, and store our product, consequently we receive pay for all the energy expended and do not lose all the profit by running our machinery when but a few of the lights are in use. Our customers are delighted with the light, and every day adds new subscribers to our circuit.

Yours truly,

(Signed)

GEO. W. WALKER, *Superintendent.*



## The Electrical Accumulator Company.

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AMERICAN FIRE INSURANCE CO.,

PHILADELPHIA, November 10th, 1887.

THE ELECTRO-DYNAMIC CO.,

*Gentlemen :*

It is now eight months since your Company put in the Electric lighting plant for the American Fire Insurance Company's building, and I take pleasure in telling you how much pleased we have all been with its performance.

It seems to me that we should be able by this time to know what defects the system has, but there has never been a day since the lights were first turned on that they have not given us entire satisfaction. It was natural, of course, that at first we should have some misgivings in placing your dynamo and Accumulator batteries in charge of our engineer, who had no experience in running an electric light plant, but he has had no trouble whatever. The plant was originally installed for 350 lights, but owing to alterations and additions made to the building, the number of lights was increased to 565. I am quite well aware that this is giving your dynamo very much more work than you warranted it to do, but it has worked most successfully. The entire plant is as efficient as when first put in service and we have had a perfectly steady and brilliant light by day and night, without heat and without the vitiation of the atmosphere in the room.

These qualities of the light make it so much preferable to gas, which we have on the same fixtures, that your batteries are called upon daily for all the service they are estimated for ; and with the 565 lamps installed in our building we have a very good basis for comparing the cost of the light with the cost of gas. With our experience we are fully satisfied that counting the interest of the cost on the plant, fuel, attendance, and all other expenses, the electric light is cheaper than gas at the present Philadelphia prices.

Yours truly,

(Signed) THOS. H. MONTGOMERY, *President.*



The Electrical Accumulator Company.

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WILLIAM WHARTON, JR. & CO., INCORPORATED.

PHILADELPHIA, December 9th, 1887.

THEODORE N. VAIL, ESQ.,

PREST. THE ELECTRICAL ACCUMULATOR COMPANY,

44 BROADWAY, NEW YORK CITY.

*Dear Sir :*

I write to say that our new 8-wheel storage battery car, equipped with 2 Reckenzaun motors and 116 cells, Electrical Accumulator Company's ("23C") make, ran yesterday with one charging the distance of 63 miles, 211 feet around the very severe track in our yard, covering in that distance 1,324 curves averaging a right angle each, and also ascending grades of 5 8-10 per cent. of a total distance of 5 miles 2,390 feet of grades. This is a remarkable performance in every way, and I thought you might be pleased to hear of it, as it is so very much in excess of the record of any other storage battery car in the world.

Yours truly,

(Signed) WM. WHARTON, JR.,

President Electric Car Company of America.

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OFFICE OF LEVI HOUSTON,

MANUFACTURER OF

LATEST IMPROVED WOOD-WORKING MACHINERY,

MONTGOMERY STATION, PA., May 25th, 1888.

L. C. KINSEY & Co.,

WILLIAMSPORT, PA.

*Gentlemen :*

The Accumulator plant of 99 cells, supplying about 130 lights in my wood-working machinery shops, which are 50x200, two stories, and about 35 lights in and about my residence located about 1,000 feet from the shops, has now been in use a little over a year, and I am highly pleased with the result. The plant has proved to be a perfect success. The expense for repairs and supplies during this time has been very light.

Yours truly,

LEVI HOUSTON.



The Electrical Accumulator Company.

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NEWPORT, R. I., Feb. 6th, 1888.

Mr. J. T. MORIARTY,

DEALER IN ELECTRICAL ACCUMULATORS,

BOSTON, MASS.

*Dear Sir :*

The plant of accumulators installed for us last December, by your Engineer E. W. Kellogg, has given perfect satisfaction from the time the lights were turned on to the present writing.

Wishing you much success in further introducing the accumulators, I remain,

Yours, etc.,

J. D. RICHARDSON, JR., *Superintendent.*

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PROVIDENCE, R. I., February 8th, 1888.

Messrs. GEO. H. THURSTON & Co.,

174 BROAD ST., PROVIDENCE, R. I.

*Gentlemen :*

The plant put in at our coal and wood yards on Eddy St., by you consisting of a 50 light Waterhouse Dynamo, 32 Cells Electrical Accumulator Company Accumulators of "15 A" size and 72 Schaefer 60 volt 16 c. p. lamps is giving us perfect satisfaction. For our purpose the accumulators are invaluable as they enable us to run our dynamo with other machinery during the day at a constantly varying speed in charging.

The ammeter showing the current to vary from 25 to 40 amperes, our engine not being closely regulated, and the heavy resistance of the Circular Wood Saws causes a considerable difference in speed. The storage batteries receive whatever current is generated and deliver a uniform current to the lamps giving us a constant, strong and pleasant light whether the dynamo is running or not.

Yours truly,

HOPKINS, POMROY & CO.



The Electrical Accumulator Company.

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FRED. M. KIMBALL & Co.,  
ELECTRICAL & MECHANICAL ENGINEERS,  
OFFICE AND FACTORY, 103 MERRIMAC ST.,

BOSTON, MASS., Jan. 30th, 1888.

J. T. MORIARTY, Esq.,

19 PEARL ST., BOSTON, MASS.

*Dear Sir :*

During the past eighteen months, we have had occasion to use and see a comparatively large number of accumulators. We find them very valuable auxiliaries to the dynamo in lighting plants, as they serve to greatly steady the current and allow the use of the lamps even when the dynamo is at rest.

We have installed them for plating, electro-etching, driving motors for surgeons, dentists and various mechanical operations, and their installation has, in every instance thus far, been attended with marked success.

We use them extensively in calibrating instruments and find them invaluable for this purpose, owing to the uniformity of the current furnished.

We find our cells are very easily taken care of and they give us no trouble.

Respectfully yours,

(Signed) FRED. M. KIMBALL & CO.

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SAUGUS, MASS., Jan. 31st, 1888.

Mr. J. T. MORIARTY,

19 PEARL ST., BOSTON, MASS.

*Dear Sir :*

The Electrical Accumulators which have been in use in my house for the past eight months, give perfect satisfaction.

The light is steady without flickering. The air is not vitiated as with light from gas.

The light is also available at all times day or night.

Truly yours,

(Signed) A. A. SCOTT.



The Electrical Accumulator Company.

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G. F. BURKHARDT'S BREWERY,  
BOSTON HIGHLANDS,

BOSTON, MASS., Feb. 6th, 1888.

MR. J. T. MORIARTY,

*Dear Sir :*

The Electrical Accumulators you set up in connection with my electrical light plant some six months ago, have done all you claim for them and I am well satisfied with the result.

Yours truly,

(Signed) G. F. BURKHARDT.

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LEICESTER, MASS., August 8th, 1888.

J. T. MORIARTY, ESQ.,

BOSTON, MASS.

*Dear Sir :*

The accumulator which you furnished us in April, has been in daily use since. We have found the light at all times clear, pleasant and steady, always at the turn of the button, turning night into day. We are entirely satisfied, and without hesitation recommend accumulators to those who are seeking the best mode of lighting private houses.

Truly yours,

(Signed) J. & J. MURDOCH.

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THE CONNECTICUT MUTUAL LIFE INSURANCE CO.

HARTFORD, July 7th, 1888.

TO THE ELECTRICAL ACCUMULATOR & LIGHTING CO.,

P. O. BUILDING, BRIDGEPORT, CONN.

*Gentlemen :*

In answer to your inquiry with regard to the Storage Battery you supplied this Company with (Connecticut Mutual Life Insurance Co.) should say that the same is giving perfect satisfaction in every way. It has shortened the daily running hours of our dynamo, and burned no



## The Electrical Accumulator Company.

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more coal since adopting it. I consider it a very useful and necessary adjunct to an incandescent plant, and cheerfully recommend it to any one contemplating a complete installation for incandescent lighting.

Yours truly,

G. S. PERKINS, ENGINEER,  
*Connecticut Mutual Life Insurance Co., Hartford, Conn.*

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THE NORWICH ELECTRIC LIGHT COMPANY,  
SUPERINTENDENT'S OFFICE, 11 AND 13 CHESTNUT STREET.

NORWICH, CONN., July 20, 1888,

THE ELECTRICAL ACCUMULATOR & LIGHTING CO., BRIDGEPORT, CONN.

B. T. SQUIER, GEN'L MANAGER,

*Dear Sir :*

Those thirteen cells of storage battery sent here from Danbury, Ct., I examined, and found them in very poor shape ; they looked as though they had very poor treatment. I took them apart and cleaned them, and got them in good shape again, and they are now in operation at my house, running ten 25 candle-power, 25 volt lamps, and giving the best of satisfaction—a nice steady light. Some of the lights run all night. I am charging with  $9\frac{1}{2}$  ampere current, and running the lights at the same time of charging. I am greatly pleased with the results of this small battery in every way.

Yours respectfully,

GEO. W. PHILIPS, *Supt.* N. E. L. Co.

P. S.—Above battery was originally delivered to parties, who afterward rejected it, upon the ground that the battery could not be made to work, and would not even run four 16 candle-power lamps.

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THE SHELTON BRASS HARDWARE COMPANY,

BIRMINGHAM, CONN., July 31st, 1888.

THE ELECTRICAL ACCUMULATOR COMPANY, 44 BROADWAY, N. Y.

*Gentlemen :*

Without any solicitations on your part, we would like to express our entire satisfaction regarding the accumulators of your make placed in our works last fall. We have a battery of 33 cells, charged by a



## The Electrical Accumulator Company.

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dynamo driven almost direct from our water wheel shaft, and have never yet found any difficulty in supplying the current from this kind of power, although we do not use a governor on our wheel, and the power is very irregular. Everything about the plant works very nicely, and the batteries are in good condition.

Yours very truly,

HENRY S. DEFORREST, *Treas.*

THE SHELTON BRASS HARDWARE CO.

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PULLMAN'S PALACE CAR COMPANY,

CHICAGO, April 11th, 1888.

J. W. JOHNSON, Esq.,

MANAGER NORTH WESTERN ELECTRICAL ACCUMULATOR CO.,  
CHICAGO, ILL.

*Dear Sir :*

I am pleased to state that the batteries furnished by The Electrical Accumulator Company of New York, about a year ago, for lighting our cars on the New York and Chicago Limited Express Trains ; as also those furnished a few months ago for the Florida Special Trains, have given excellent satisfaction.

Yours truly,

(Signed) T. H. WICKES,

*General Supt.*

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FRANK H. GARDINER, M.D., D.D.S.,

126 STATE ST.,

CHICAGO, May, 1888.

THE NORTHWESTERN ELECTRICAL ACCUMULATOR CO.,

223 PHENIX BUILDING, CHICAGO, ILL.

*Gentlemen :*

The two cells of accumulator furnished by Johnson, Holland & Co. in July, 1887, continue to give excellent satisfaction.

They have required no attention on my part, and are charged at trifling expense from the dynamo in the building in which my office is located. The two small cells referred to are at the present time supply-



The Electrical Accumulator Company.

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ing current for two dental engines, the one in my office and one in Dr. Freeman's office. The cells are charged only twice a month.

They replace six cells of primary battery, and give much better satisfaction in every respect.

Yours truly,

(Signed) FRANK H. GARDINER.

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OFFICE OF

SUPERINTENDENT OF PUBLIC SERVICE OF COOK COUNTY,

ROOM 29, COUNTY COURT HOUSE,

CHICAGO, May 21st, 1888.

JAS. W. JOHNSON,

MANAGER NORTHWESTERN ELECTRICAL ACCUMULATOR Co.,

CHICAGO, ILL.

*Dear Sir :*

In answer to your inquiry, as to how we were pleased with the ball of electric lights furnished Christ Church Sunday School for use at its Easter festival and supplied by one of your electrical accumulators, would say that we were very much pleased with it in every respect.

Its operation was prompt and efficient, we could not have asked to have it any better. For the purpose wanted—that of temporary illumination—I could not conceive of anything better.

Yours truly,

(Signed) JOHN BENHAM.

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ROBBINS & APPLETON,

CHICAGO, May 21st, 1888.

NORTHWESTERN ELECTRICAL ACCUMULATOR Co., CITY.

*Gentlemen :*

We take pleasure in stating that the accumulators purchased from you in February last have been in constant service, and continue to give perfect satisfaction.

Yours truly,

(Signed) ROBBINS & APPLETON,

R. A KETTLE, *Manager.*



The Electrical Accumulator Company.

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BAUGH STEAM FORGE CO.,

DETROIT, MICH., June 28th, 1888.

GEORGE E. FISHER, Esq.,

MANAGER, THE ELECTRICAL ACCUMULATOR AND LIGHTING CO.,  
CITY.

*Dear Sir :*

Replying to yours of the 20th, would say we are burning only a portion of the lights at present, but apparently the storage battery is in good condition, and is working satisfactorily so far as it is being used.

Yours truly,

(Signed) BAUGH STEAM FORGE CO.,

R. D. FIELD, *Secretary.*

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DETROIT, June 18th, 1888.

THE ELECTRICAL ACCUMULATOR AND LIGHTING CO.,

CITY.

*Gentlemen :*

I voluntarily submit these few lines. Your light is simply perfection, and I am more than pleased with it. My neighbors in business all want it.

Wishing you success, I remain

Yours truly,

(Signed) W. H. GAMBRECHT.

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JOHN P. LIEBERMAN,

84 GRATIOT AVENUE,

DETROIT, MICH., June 18th, 1888.

ELECTRICAL ACCUMULATOR AND LIGHTING COMPANY,

CITY.

*Gentlemen :*

Your inquiry at hand. Would say in reply that the storage incandescent lights placed in my establishment give excellent satisfaction in



The Electrical Accumulator Company.

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every particular, and find it a saving of nearly fifty per cent. difference in the cost of light furnished by the Mutual Gas Light Co. of this City, and can say furthermore that for quality, quantity and brilliancy, it is the very best we have ever used.

Yours truly,  
(Signed) JOHN P. LIEBERMAN.

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JOHN C. HARTZ,  
DETROIT, MICH., June 19th, 1888.

ELECTRICAL ACCUMULATOR AND LIGHTING COMPANY,  
CITY.

*Gentlemen :*

You ask me what I think of your lights : In reply will say with your storage battery you certainly have the advantage over any other system of incandescent lighting and the light is all you claim for it.

Respectfully,  
(Signed) JOHN C. HARTZ.

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HUGO H. STENDER,  
40 MONROE AVE.,  
DETROIT, MICH., June 19th, 1888.

ELECTRICAL ACCUMULATOR AND LIGHTING COMPANY,  
CITY.

*Gentlemen :*

Your incandescent light from storage battery is fully up to the claims you make for it, being brilliant, clean and economical. Success is with you.

Yours truly,  
(Signed) HUGO H. STENDER.

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DETROIT, MICH., June 26th, 1888.

ELECTRICAL ACCUMULATOR AND LIGHTING COMPANY,  
CITY.

*Gentlemen :*

I am pleased to state that the incandescent lights placed in my place give the very best of satisfaction, and they are very much admired by my customers.



## The Electrical Accumulator Company.

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The storage system of incandescent lighting is beyond question a step in advance of any other incandescent service, as my experience proves, and you must eventually lead and sweep from your path all others in this line.

Yours truly,

(Signed) J. BUCKLEY,

30 Woodward Avenue.

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TELEPHONE AND TELEGRAPH CONSTRUCTION COMPANY,

NEWBERRY AND McMILLAN BUILDING,

DETROIT, MICH., June 18th, 1888.

ELECTRICAL ACCUMULATOR AND LIGHTING COMPANY,

GEO. E. FISHER, Gen'l Manager,

DETROIT, MICH.

*Dear Sir :*

In reply to your inquiry of to-day, we are pleased to be enabled to say that the forty-three incandescent lamps by which our operating room, general offices and local exchange business office have been lighted from the storage battery for the past six or seven months, have given perfect satisfaction. The service during that time has been absolutely free from defects.

Yours truly,

(Signed) F. A. FORBES,

*Gen'l Supt.*

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DETROIT, June 20th, 1888.

ELECTRICAL ACCUMULATOR AND LIGHTING COMPANY,

CITY.

*Gentlemen :*

Yours of the 19th received, and in reply would say my experience with the incandescent light has been satisfactory to me. I have used



The Electrical Accumulator Company.

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all the other electric lights and find yours far ahead of all others for brilliancy and steadiness.

Yours truly,

(Signed) LOUIS L. DETCHLANY.

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C. LINGEMAN & CO.,

26 MONROE AVENUE,

DETROIT, MICH., June 19th, 1888.

ELECTRICAL ACCUMULATOR AND LIGHTING COMPANY.

*Gentlemen :*

Answering your inquiry would say that the storage incandescent light placed in our building, is fully up to the claim you make for it, and is, in our opinion, superior to any other incandescent light we have used.

Respectfully,

(Signed) C. LINGEMAN & CO.

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DETROIT, MICH., June 2d, 1888.

ELECTRICAL ACCUMULATOR AND LIGHTING COMPANY,

DETROIT, MICH.

*Gentlemen :*

Yours regarding the incandescent lights placed in our store received. We cannot say too much in their favor. The lights are always steady, bright and up to full candle power.

We had gas fixtures in the store, but took them out after thoroughly satisfying ourselves as to the reliability of your system. We do not see how the light can ever fail us, as you always have a supply of current in our basement.

We have used the incandescent lights furnished by other companies and the volume of light given by your 16 candle power lamps is at least twenty per cent. greater than others that we have used. As we know what this light will cost from month to month, we think your system is without fault, and will take the lead in incandescent lighting.

Yours truly,

(Signed) R. WAGNER & CO.



## The Electrical Accumulator Company.

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The following testimonials are from parties having Accumulator plants installed in England :—

From SIR WILLIAM THOMSON, F.R.S.,  
THE UNIVERSITY, GLASGOW,

15th March, 1886.

Your storage cells have given me the greatest satisfaction. I have used 44 of them for my house lighting ever since I got them first charged up within a few days after receiving them from you, and they have worked to perfection. It is the greatest possible comfort to us in the house to have light with satisfactorily equal brilliancy at all hours of night or day, and every day of the week. I have now cut off the gas at the meter, so that there is absolutely none used in the house. I have no oil lamps, and have not used so much as a single quarter of a candle within the last three months, as I have the electric light in every part of the house where light can possibly be wanted by night or by day. I find by a little management of throwing off a few cells from the house circuit when the engine is going, and throwing them on when it is stopped, that there is no difficulty in keeping the potential at the house within 2 or 3 per cent. of absolute constancy.

I use a Clerk gas engine to drive the dynamo, and find that it is impossible to tell by the appearance of the lamps whether the engine is going or not. Before I had your secondary battery we could always see a pulsation of the lights in time with the revolutions of the engine. The absolute steadiness of the light which we now have is most satisfactory and pleasing.

I have six of your cells continually in use on my Laboratory table, and they are charged according to need, by joining them up parallel and putting them into the charging circuit, so that when they are being charged, the engine is called upon to work against a potential of 45 cells, instead of, as usual, a potential of 44 cells. This makes scarcely any sensible difference to the engine ; it merely lets it go a little faster, and causes it to give a slightly smaller current. Of course, a sixth part of this charging current passes through each of the Laboratory cells. I use these cells for Laboratory purposes, sometimes keeping them joined in parallel, and sometimes joining them in series, according to my Laboratory needs. It is a great convenience to me to



## The Electrical Accumulator Company.

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be able to get at any moment 180 amperes for testing and adjusting my electrical measuring instruments. With this varied and irregular use in my Laboratory, the six cells keep in perfectly good order. I suppose, if I take care never to run them down too low, they will keep in good order for years?

WILLIAM THOMSON.

THE UNIVERSITY, GLASGOW.

7th September, 1887.

\* \* \* I have much pleasure in stating that the secondary battery continues to serve its purpose most satisfactorily, and has given scarcely any trouble since it was first set to work in November, 1885.

The six cells which I use for Laboratory testing are keeping in very good order, although they are frequently used at their maximum rate of discharge.

WILLIAM THOMSON.

From W. H. PREECE, Esq., F.R.S.

GOTHIC LODGE, WIMBLEDON,

February 23d, 1887.

I have had 26 of your 15 L cells at work in my house since January 29th, 1886, and during the whole of that period they have never developed one single fault nor caused one moment's anxiety. They are now apparently as sound as they were when they were first put in, and I see no signs of deterioration. They give an unfailing and perpetual source of electricity, and their pressure has never fallen 5 per cent., although I have frequently drawn upon them severely.

As I have frequently stated, no electric light installation is complete without a set of secondary cells.

W. H. PREECE.

CHERKELEY COURT, LEATHERHEAD,

August 26th, 1887.

I have much pleasure in informing you that the installation of about 80 Swan Incandescent Electric Lamps that you have lately erected for me, worked by a Manchester Dynamo charging 53 of your cells and by an 8 h. p. steam engine at a distance of 200 yards from my



## The Electrical Accumulator Company.

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house, has so far given me great satisfaction, and the light is very brilliant and very convenient and safe; and the 16 candle-power lamps are more powerful than "Hinks Duplex Light" Lamp that I have hitherto used.

ABRAHAM DIXON.

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THE WYLDs, LISS, HAMPSHIRE,

September 10th, 1888.

The Electric Installation here has now been completed some months, and the ease and regularity of the lighting by electricity has made it the most perfect success. Of the 53 cells, we have never had to use more than 50, and with these 50 we get a brilliant light—perfectly steady.

HARRY TAYLER.

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20 PARK SQUARE, REGENT'S PARK, N. W.,

September 19th, 1887.

I have great pleasure in expressing my entire satisfaction with the Electric Installation your Company put up for lighting my house. I have now had some months' experience with it, and during that time the whole has worked with great regularity and with an infinitesimal amount of trouble.

Your E. P. S. Storage Cells, which form so important a portion of an installation and are absolutely necessary for efficient Electric lighting in private houses, have worked in the most satisfactory manner. By their use a perfectly steady light is obtained; moreover, it is only by means of them that a light can be obtained at any moment, a matter of great consideration under a variety of circumstances.

The Dynamo you supplied gives out a large amount of efficiency in respect to the motor force employed.

I have no hesitation in expressing my opinion as to the agreeableness and convenience of the Electric Light; also the advantages of the absence of heat and impurities of combustion are very great. Bearing in mind these conditions and the very little attention the apparatus necessitates, I am convinced its use in private houses must considerably extend.

T. J. ASHTON.

[*N. B.—Since the above date the E. P. S. Co. have greatly enlarged this installation.*]



## The Electrical Accumulator Company.

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THE WARREN, WOOTTON-UNDER-EDGE, GLOUCESTERSHIRE,

September 26th, 1887.

I should also be glad if you could give me prices of dynamo, motor and accumulators. I have been using your accumulators for the last two years, and finding them answer so well, should like to increase their use if I could make them answer my purpose.

An early answer would oblige,

E. H. TOULMIN.

PENINSULAR AND ORIENTAL STEAM NAVIGATION COMPANY,

OFFICES 122 LEADENHALL STREET, LONDON, E. C.,

30th July, 1886.

In reply to your enquiry, I beg to say that the large set of accumulators referred to in Mr. Sutherland's letter of the 20th May, 1885, is still in use here, and appears to be little worse for twenty months' hard work.

There has been passed through the cells during the period named upwards of 85,000 ampère hours, the maximum discharge being at the rate of about 100 ampères, and the largest monthly aggregate (in December last) 7,400 ampère hours.

On examining the cells after this large amount of work, I can find no signs of breaking down beyond some slight blistering of a few of the plates; there has been no "buckling"—no "sulphating," and the only "short circuits" have been a few trifling contacts caused by little pieces of the blisters above referred to.

There is no reason, in my opinion, why the plates should not remain effective for at least twelve months longer.

CHARLES HALL.

LAURISTON, BROMLEY, KENT,

4th May, 1885.

The set of cells you supplied me with about a year ago are still in serviceable condition, and the plates seem as though they would last for a considerable time yet.

I have not done anything to them since they were put in action

\* \* \* \* \*



## The Electrical Accumulator Company.

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I have found the cells exceedingly useful in three ways: As regulators for steadying the current; as accumulators for giving, on exceptional occasions, a larger supply of current than my dynamos alone give; and as reservoirs, enabling me to have current at command for lighting or other purposes at all hours, night and day.

JOSEPH W. SWAN.

ROKHOLT, CANNOCK,

29th August, 1887.

Regarding your letter of 26th as to the battery I had of you, I am glad to say I have had no trouble except having to put fresh water in, but as my steam engine is in the same small building with the cells, I fear I have lately had to put in water much oftener than necessary from the working only. I see no difference in the plates when first started eighteen months ago. I have had them in work every night.

I have used the acid as you directed me, and I fancy some of the cells are higher in sp. gravity, but it is not long since I began.

I have put sheets of glass across the cells, in the hope that I may return some of the acid bubbles which fly off and collect thereon.

F. D. BUMSTED.

ELECTRICAL WORKS AND SHOWROOMS,

39 LEVER STREET, MANCHESTER,

September 24th, 1887.

We have pleasure in informing you that the E. P. S. cells you supplied us with some eight months ago have given every satisfaction, requiring no further attention than the necessary charging and the occasional addition of a little water.

We ourselves should recommend their being used in all installations, especially so in domestic lighting, in which case an electric light installation would be incomplete without a set of accumulators.

We may add, that, as far as we are capable of forming an opinion from our eight months' experience of the cells, that they would last a considerable time, much longer than is generally supposed, providing they are well charged at time of charging.

ROWBOTHAM & WORSLEY.



## The Electrical Accumulator Company.

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WESTFIELD, COVENTRY,

June 10th, 1887.

I am most satisfied with my accumulators. Their storage capacity is very great, and for some time past I have had no trouble in their equality.

I find with my little engine ( $\frac{1}{2}$ -horse Otto) it is much more economical to charge them half at a time.

CHARLES BROWETT.

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57 BASINHALL STREET, LONDON, E. C.,

September 14th, 1887.

I am pleased to be able to state that the fifty-two 31 L type cells you supplied me with in October last for Mr. Czarnikow, Effingham Hill House, have up to the present time given every satisfaction. There has not been a bad cell among them, and but one case of buckling through the unnoticed evaporation of the electrolyte in one cell. They are remarkably free from sulphate.

EVAN A. SULMAN.

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WHITE MILLS, DUNLEER, IRELAND,

August 24th, 1887.

The accumulators supplied have given me the most complete satisfaction so far, and have been subjected to rough usage, and only two of them failed for a day or so by means of a short circuit between the plates, which was very easily put right. I am in communication with some of the leading brewers here whom the times have not affected so much, for an installation, and I hope shortly to have the pleasure of remitting you your account with a fresh order for accumulators.

JOHN HENRY.

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MOORSIDE, NEAR HALIFAX,

26th July, 1886.

I have much pleasure in replying to your request that I should give you my experience relating to the E. P. S. cells I obtained from your Company.



## The Electrical Accumulator Company.

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I put them down in February last, but can conscientiously say that they have not given me one minute's trouble since I got them.

As you know, they are of the 31 L type pattern, twenty-four in number. I use 42 volt lamps—charge the whole of the cells with a dynamo and gas engine, which my gardener attends to. At the present time of the year I charge two hours three times per week.

I have about 120 lamps in the house, but the number in use varies very much. I seldom find it necessary to draw out more than 35 or 40 amperes at a time, and the average is much below this. Of course, as winter comes upon me I shall require to run the engine more frequently. The price of gas as supplied by the Corporation of Halifax is 2s. per 1,000 ft. nett, and I burn about 270 ft. per hour when charging, putting into the accumulators at the rate of about 40 amperes at a pressure of 50 volts per hour.

I tried several forms of storage batteries before yours, but with varying success, and from my experience of the E. P. S. cells there remains nothing to be desired. For lighting the house I only use 22 cells, leaving the extra two as a reserve in case of necessity, which I have never yet had to use.

I use a Ferranti current meter as a check for the amount put in and drawn out, and always run the engine so as to leave a fair margin of a credit balance, allowing for extra volts when charging, and leakage. It will be seen that the cost of gas per hour for engine purposes is only about 6½d., but I should add that my engine, being a large one, and necessary as I have a large workshop, it is not so economical when running simply to charge accumulators, as there is a considerable amount of waste in friction. From figures obtained from the engine when charging the accumulators, I find it takes 3.6 i. h. p. to charge them at the rate of 2,250 Watts.

L. J. CROSSLEY.

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28 AUSTIN FRIARS, LONDON, E. C.,

May 2d, 1885.

We have had your storage batteries in use upwards of two years, and the defects in their manufacture, which at first impaired their usefulness, have been completely removed by the improvements you have introduced. The batteries we now have are thoroughly reliable, and give us entire satisfaction.

FOSTER & BRAITHWAITE.



## The Electrical Accumulator Company.

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UNIVERSITY COLLEGE, LIVERPOOL,

PHYSICAL LABORATORY,

11th May, 1885.

I have had some of your cells in constant work in this Laboratory since February, 1883, and find them altogether invaluable. They have been overhauled twice or three times, and the original number has become reduced, but only once have altogether new positives been introduced, and those only in some of the cells.

The cells are charged about every week by a small gas engine, and they are used for all Laboratory purposes, wires being laid from the battery house to all parts of the Laboratory, so that one, two, or a number of cells may anywhere be laid on. The whole number work five Swan lamps in my private room at night, and for lectures I use them to run the Serrin lamp for protection, sometimes without, but usually with, the engine running at the same time. Grove cells are in fact now practically discarded, and the extreme handiness of having a current always on whenever wanted cannot be over estimated. Moreover, the strength and steadiness of the current they can give, and the small compunction one has in short circuiting them, as compared with Grove cells, render them peculiarly useful.

For all small electric light installations, such as that for a single house, I regard some mode of storage as essential. One cannot be at the mercy of a gas engine and dynamo, except in the most elaborate and carefully superintended installations. For large concerns direct driving may answer, because duplicate appliances and systematic and constant supervision may nullify the risk of accident; but even in such cases the convenience of having a light at any hour of the twenty-four, without constant running of machinery, is considerable. For small installations, however, there can hardly be a difference of opinion as to the necessity for storage.

The durability of your cells is now very fairly satisfactory, and the fact that plates wear out not by loss but by accretion, the lead being still all easily recoverable, renders renewal of worn-out plates a matter of small cost.

I consider that storage batteries have, therefore, now reached a sound commercial stage, at which their extensive use may be distinctly recommended.

OLIVER J. LODGE.



## The Electrical Accumulator Company.

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In reply to your enquiry as to my experience of the storage batteries supplied by your Company for lighting my private house, I have pleasure in making the following statement :—I have had the accumulators in daily use for two years and a half, during which time they have given me entire satisfaction. The only attention I have given them has been to supply them with water to replace that lost by evaporation. I have just had my positive plates replaced, as the original ones were worn out ; the cost of this was trifling, and I anticipate that the new plates will last me two or three years. I am thoroughly satisfied with my experience, having by the use of your accumulators had the electric light available like gas at any moment, day and night, and absolutely steady.

J. B. BRAITHWAITE, JUN.

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33 CHESHAM PLACE, S. W.,

25th July, 1885.

Thanks for your enquiries as to the state of the accumulators supplied to me. They appear perfect, and the leakage is almost nil, so far as my testing from time to time enables me to form an opinion. I do not believe in much further perfection, except, perhaps, for large quantities or condensed electricity. No domestic installation can be satisfactory without accumulators, not only on account of perfect steadiness of the lamps, but of the immense comfort of not requiring an engine and dynamo at night, on Sundays, &c.

I am very glad the PRINCE OF WALES has taken it up, but, personally, I do not believe in storage without one's own dynamo—it is the combination that is perfection—and I believe, very shortly, both will be introduced into every large country house, every factory, every school, every theatre, and every hotel in the United Kingdom.

THURLOW.

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BROOMHILL, TUNBRIDGE WELLS,

May 2d, 1885:

I have had your cells in use since November, 1883, and they have proved a great boon to me.

Careful attention should be given to the instructions sent out by the Company in order that the best results may be obtained.



## The Electrical Accumulator Company.

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Although a large loss of efficiency must result from any system of storage, as large perhaps as 20 to 25 per cent., yet there is a considerable gain in other things. For instance, the engine need not be running early in the morning or late at night when only a few lamps are in use, and when there is no party at the house, the engine need but run a few hours in the day, or even at intervals of some days.

Taking all into account, I find that electric light with cells cost me more than before I adopted them, but with the new designs their extra cost will be much diminished or disappear altogether, yet I could not do without them for a perfectly steady light; and the current on day and night for light and power, even when the engines are under repair, or are not running from other causes, is a matter of such convenience and importance that any expense would be cheap for the return obtained, and at best the increased expense in an installation of 50 to 100 lamps of 20 candle power would be very small as compared with the total expense, not more than £5 to £10 a year, if interest on the cost of the cells is excluded, I assuming that the installation is well designed and proportioned, and that the cells are properly used.

If my remarks are long, I must plead excuse on the ground of the difficulty which exists in speaking upon a matter in which the public is not yet well educated, but I have endeavored to give a fair opinion without giving "color" to either side of the case.

DAVID SALOMONS.

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91 CHARTERHOUSE STREET,

LONDON, E. C.,

29th July, 1887.

We have pleasure in stating that we are well satisfied with the Electric Light Appliance fitted up by you at our premises, the trial having proved the efficiency of the dynamo and accumulators, in accordance with your contract.

JOHN BELL & SONS.



## The Electrical Accumulator Company.

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THE BREWERY, ALDERMASTON, NEAR READING,

October 6th, 1887.

I have much pleasure in saying that the cells (11, 11R plates, 22 volt lamps) supplied to me in April, 1886, and which have been in regular use since June 1st in that year, have given me great satisfaction.

J. T. STRANGE.

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From *The Morning Post*, 29th December, 1885.

### ELECTRIC LIGHT IN PRIVATE HOUSES.

TO THE EDITOR OF "THE MORNING POST."

SIR:—Having now tried for twelve months the experiment of entirely lighting my residence and offices with the electric light, the result of my experience may be of some general interest. The installation here was carried out by the Electrical Power Storage Company, with twenty-seven of their patent accumulators (31 L type), twenty-four of which are in constant use, with three in reserve. The power is obtained from an Otto gas engine, erected by Waygood, of 1 horse power nominal, indicating nearly 2 horse power, and an Edison dynamo of 90 volts, 16 amperes. The house, including bed-rooms, is lighted by fifty Swan incandescent lamps of 50 volts and 20 candle power each, burning a current of 1.3 amperes per hour. On the 31st of October the installation had been working twelve months most successfully; in fact, during this period we have never been without the light for a single night. There has been one or two slight breakdowns with the engine and dynamo, necessitating the stoppage of work for one or two days, but on each occasion the amount of electricity stored in the accumulators has been sufficient to keep the house well lighted for nearly a week. The accumulators, after their twelve months' work, do not evince any sign of deterioration, and I am informed they should last for some years yet, and when necessary to replace the plates, it can be done at a small cost. The Edison dynamo gives a current varying from 12 to 15 amperes, which from such a small power engine is very satisfactory. The armature makes from 1,260 to 1,320 revolutions per minute, and there is not the slightest heating in any part of the machine. The fifty lamps throughout the house are all turned on and off by separate switches, with the exception of the cluster lights or "Electroliers" in the principal rooms, which have one switch for each cluster of five or six lights



## The Electrical Accumulator Company.

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In each bed-room are two lamps in the usual position by the dressing tables, one of which can be turned on just inside the door, and the other by the bed side, and this mode of arranging the switches at the entrance to each room has been generally adopted ; attached to each switch is a safety fuse. The dining-room having an enriched plaster ceiling, the question of carrying the wires was one of some difficulty, but it was so managed by careful manipulation that the most critical observer would fail to detect the mode in which they are carried round delicate mouldings from the wall to the centre of the ceiling. The engine has worked on an average for the year four and a half hours a day, at a cost per diem of a fraction under 6d. The total cost of the installation, exclusive of fittings, was about £300. The engine and dynamo have been looked after by an electrician, who comes generally every other day, but the daily working of the machinery for the first nine months has been under the superintendence of my son, since which time one of the gentlemen in my office has taken it in charge. The working expenses have been as follows : Payment to electrician, £12 12s. 6d. ; gas for engine, £8 15s. 2d. ; repairs to engine, £1 19s. ; oil for engine, £2 4s. 1d. ; repairs to dynamo, 7s. 9d. ; attachments, 9s. ; breakage of 15 lamps at 5s., £3 15s. ; waste, laces for belt, and sundries, 8s. 9d. ; total, £31 5s.

I have also kept a register showing how many amperes have been burnt nightly by each lamp, and by that means can tell to an hour the life of every lamp that has broken. The machinery is in a room about eleven feet by ten feet, on the basement, and immediately under the room in which I pass most of my time, and there is not the slightest vibration or noise. I am quite convinced that for absolute steadiness of light the working by means of accumulators is the best plan, and whenever the lighting by electricity takes a more extended form, and "centres" for producing it are established, accumulators, it appears to me, will then be advantageous to prevent the pulsation of the lights, and to provide against a possible break down of machinery at the "centres." At the end of the twelve months' trial I am quite satisfied with the result of my experiment, the rooms are never overheated from the fumes of gas and the ceilings and wall decorations are as clean and free from deterioration as when first put up.

I am, Sir,

CHARLES J. PHIPPS, F.S.A.

26 Mecklenburgh Square, Dec. 28th.



## The Electrical Accumulator Company.

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*Testimonial from W. H. Preece, Esq., F.R.S., Electrician, General Post Office, St. Martin's-le-Grand.*

POST OFFICE, February 2d, 1888.

Your E.P.S. Cells have now been at work in my house for exactly two years, and I have never had one moment's failure during the whole of that time. There has been only one trifling fault in one cell, but that did not affect the light. I have not spent sixpence upon them, and they now look as well as ever.

W. H. PREECE.

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FIELD HEAD MILL, BRADFORD,

21 December, 1887.

MR. DAVID HARRIS.

*Dear Sir :*

In reply to your inquiry respecting the installation work you fixed at my house, I have pleasure in stating that it is very satisfactory in every respect. We have had no trouble with the working of it, and I know of at least one job that your firm has got in consequence of the satisfactory manner in which mine has worked. I may add that under no circumstances would my people at my house go back to gas light.

Yours truly,

J. SMITH.

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WILLIAM ACKROYD & Co.,

WORSTED SPINNERS,

OTLEY MILLS, YORKSHIRE, February 8th, 1888.

I have great pleasure in stating that the lighting of my house throughout by dynamo at the Mills through accumulators, has given me very great satisfaction. The work has been carried out under the management of Mr. Harris.

J. ARTHUR DUNCAN,

WEST BOURNE, OSTLEY.



# LIST OF ACCUMULATOR PLANTS

INSTALLED AND NOW IN SUCCESSFUL  
OPERATION.

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*Accumulators in Use in Connection with*

## CENTRAL STATION PLANTS,

—AT—

Saratoga.....	New York
Cooperstown.....	“
Haverford (supplying Haverford, Bryn Mawr and Ardmore).....	Penna.
Allentown.....	“
Bethlehem.....	“
Watsonstown.....	“
Honesdale.....	“
Spring Grove.....	“
Lehighon.....	“
Phillipsburgh.....	“
Jersey City.....	New Jersey
Cherryfield.....	Maine
Brunswick.....	“
Springfield.....	Massachussetts
Roxbury... ..	“
Detroit.....	Michigan
Flint.....	“
Newport.....	Rhode Island
Burrton.....	Kansas
Missouri Valley.....	Iowa



## ISOLATED PLANTS.

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### NEW YORK CITY, N. Y.

American Bank Note Company.  
Dakota Flats.  
Gallatin National Bank.  
American Express Company Office.  
American Express Company Stables.  
Mills Building.  
London and Liverpool and Globe Insurance Company.  
New York Improved Real Estate Company, No. 80 Broadway.  
New York Improved Real Estate Company, No. 44 Broadway.  
Metropolitan Telegraph and Telephone Company Building.  
Sawyer-Man Electric Company's Factory.  
Electric Club, 17 East 22d Street.

### PHILADELPHIA, PA.

Orthopaedic Hospital.  
J. B. Stetson & Co's Mill.  
Electro-Dynamic Company.  
American Fire Insurance Company.  
Fidelity Trust Company.  
Pennsylvania Trust Company.  
Provident Life & Trust Company.  
Pennsylvania Railroad Company (4th Street).  
Brown Brothers' Building.

### BOSTON, MASS.

American Rubber Company.  
The Massachusetts General Hospital.  
Savannah Steamship Company.  
Automatic Electric Company.  
Cyclorama Building.  
Fuller & Holtzer.  
Fred M. Kimball & Co.  
Institute of Technology.



## The Electrical Accumulator Company.

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### CHICAGO, ILL.

The North-Western Electrical Accumulator Co's Offices.  
Thompson-Taylor Spice Company.

J. S. Townsend.

Dr. F. H. Gardner.

Hibbard, Spencer, Bartlett & Co.

Robbins & Appleton.

E. S. Pike.

### DETROIT, MICH.

Metcalf Bros.

James McMillan.

Baugh Steam Forge Company.

Electrical Accumulator & Lighting Company's Offices.

Newbury & McMillan.

Fulton Iron & Engine Works.

### KANSAS CITY, MO.

Interstate Electric Company's Office.

Wittich & Penfield.

Kansas, Fort Scott and Gulf R. R. Shops.

Beahan & Maffatt Spice Mills.

### MASSACHUSETTS.

Fuller & Holtzer.....Brookline, Mass.

W. F. Weld.....Brookline, “

J. M. Sears.....Southboro, “

A. A. Scott.....Saugus, “

G. F. Burkhardt (Brewery) .....Roxbury, “

Commonwealth Shoe and Leather Co. ....Whitman, “

Thomson-Houston Company.....Lynn, “

J. & J. Murdock (two residences and mills).....Leicester, “

W. H. Ames.....North Easton, “

### CONNECTICUT.

Electrical Accumulator and Lighting Co.....Bridgeport, Conn.

E. H. Johnson, Prest. Edison Electric Light Co....Greenwich, “

Shelton Brass Hardware Co.....Birmingham, “

Mutual Life Insurance Company Building.....Hartford, “

Norwich Electric Light Co....Norwich, “

Standard Electric Time Co.....New Haven, “



## The Electrical Accumulator Company.

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### TEMPORARY INSTALLATIONS.

Geo. W. Hollingsworth.....	Harlem, N. Y.
40 lights on Christmas tree, three hours each night for seven nights.	
Ogden Mills, residence.....	Fifth Ave., N. Y.
60 lights at private ball given Monday, Jan. 10th, 1888.	
Cornelius Vanderbilt, residence.....	Fifth Ave., N. Y.
100 lights at private ball given Monday, Jan. 23d, 1888.	
Lighting Easter Crown of Roses, Church of the Holy Spirit..	
State Military Encampment.....	New York.
100 lights, one week.	
Siege of Troy Company.....	South Framingham, Mass.
Lighting large floral center piece and awning.	
Private reception, house of Judge Dent.....	Chicago.
Decorating floral piece, real estate broker's banquet, Grand Pacific Hotel.....	Chicago, Ill.
Decorating floral piece placed in fire place and lighting awning, reception at house of John B. Drake.....	Chicago, Ill.
Lighting Easter device, Christ Church Sunday School ...	“
Illuminating picture “Christ before Pilate”.....	“

### LABORATORY PURPOSES.

Stevens Institute of Technology.....	Hoboken, N. J.
Cornell University .....	Ithaca, N. Y.
College of the City of New York. ....	New York
Thos. A. Edison.....	Orange, N. J.
Edward Weston.....	Newark, “
E. Berliner... ..	Washington, D. C.
United States Naval Academy.....	Annapolis, Md.
W. F. Brown.....	Monticello, Minn.

### STREET CAR PROPULSION.

Electric Car Co. of America.....	Philadelphia, Pa.
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### STREET CAR LIGHTING.

Citizens' Railway Co.....	St. Louis, Mo.
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## The Electrical Accumulator Company.

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### STEAMBOAT LIGHTING.

Steamer "Rosedale."

### YACHT LIGHTING.

	OWNER.
Steam Yacht "Susquehanna".....	Joseph Stickney.
" " "Cora".....	John A. Morris.
" " "Sagamore".....	John W. Slater.
" " "Talisman".....	W. A. Slater.
" " "Seneca".....	Geo. F. Fabian, Boston
" " "Nourmahal".....	Wm. Astor, New York
Yacht, "Vita".....	Mr. Fabyan, Trenton, Mich.

### ELECTRIC LAUNCHES.

	OWNER.
"Magnet".....	Frederick Reckenzaun, Newark, N. J.
"Elektron".....	Joseph Bigler, Newburgh, N. Y.
Small Launch.....	J. L. Riker, Seabright, N. J.
" ".....	Geo. N. McKibben, Loon Lake, N. Y.
Launch.....	H. K. Sturdy, Attleboro, Mass.

### OPERATING SUB-MARINE LAMPS.

James Campbell.....	Honolulu, S. I.
(Sub-marine lamp for fishing.)	
John G. Mairs.....	Troy, New York.
(Lamp for inspecting bottom of reservoir.)	

### TELEPHONE SWITCHBOARDS.

Bell Telephone Co. of Missouri.....	St. Louis, Mo.
Metropolitan Telephone Co.....	New York City.

### MEDICAL AND SURGICAL PURPOSES.

Waite & Bartlett.....	New York
E. J. Mallett.....	"
E. J. Mallett.....	Washington, D. C.
Dr. W. D. Ames.....	Chicago, Ill.
Dr. Wildman.....	"
Dr. Hunt.....	"
Hausmann, McComb & Dunn.....	"
Dr. M. H. Lackersteen.....	"



The Electrical Accumulator Company.

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ELECTRO-DEPOSITION OF METALS.

American Bank Note Company.....New York  
Reed & Barton.....Taunton, Mass.

ELECTRIC BRAKES.

Lehigh Valley Railroad.....Mauch Chunk, Penna.

ELECTRIC SWITCHES.

Railway Switch Company.....Jenkintown, Pa.

PROPELLING TRICYCLE.

Fred. M. Kimball.....Boston, Mass.

PORTABLE LIGHTING.

H. C. Wirt.....Boston, Mass.

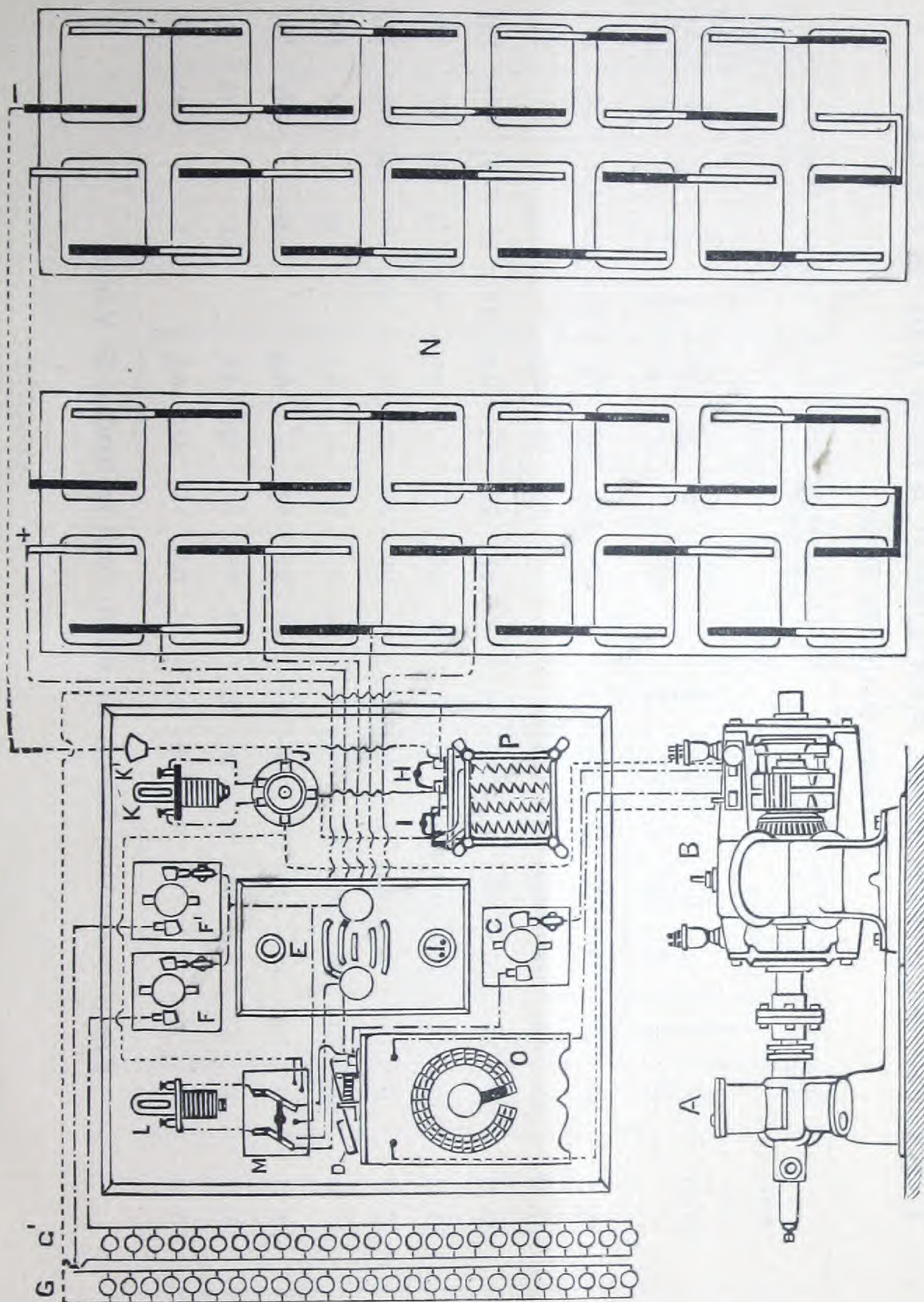
CARRIAGE LIGHTING.

J. N. Keller.....Newton, Mass.



# The Electrical Accumulator Company.

DIAGRAM SHOWING SWITCHBOARD AND ACCUMULATOR CONNECTIONS.



A, Engine. B, Dynamo. C, Dynamo Knife Switch with Safety Catch. D, Automatic Break Switch. E, Compound Regulation Switch. F F1, Knife Switches with Safety Catches on Lamp Circuits. G G1, Lamps. H, Over-Discharge Switch. I, Overload Switch. J, Multiple Circuit Ammeters Switch. K, Ammeter. K1, Current Indicator. L, Voltmeter. M, Multiple Circuit Voltmeter Switch. N, Cells. O, Dynamo Rheostat. P, Resistance Box for I and H.

— Positive Wires. --- Negative Wires.



LIST OF ELECTRICAL ACCUMULATOR CO.'S CELLS.  
(Approximate Data.)

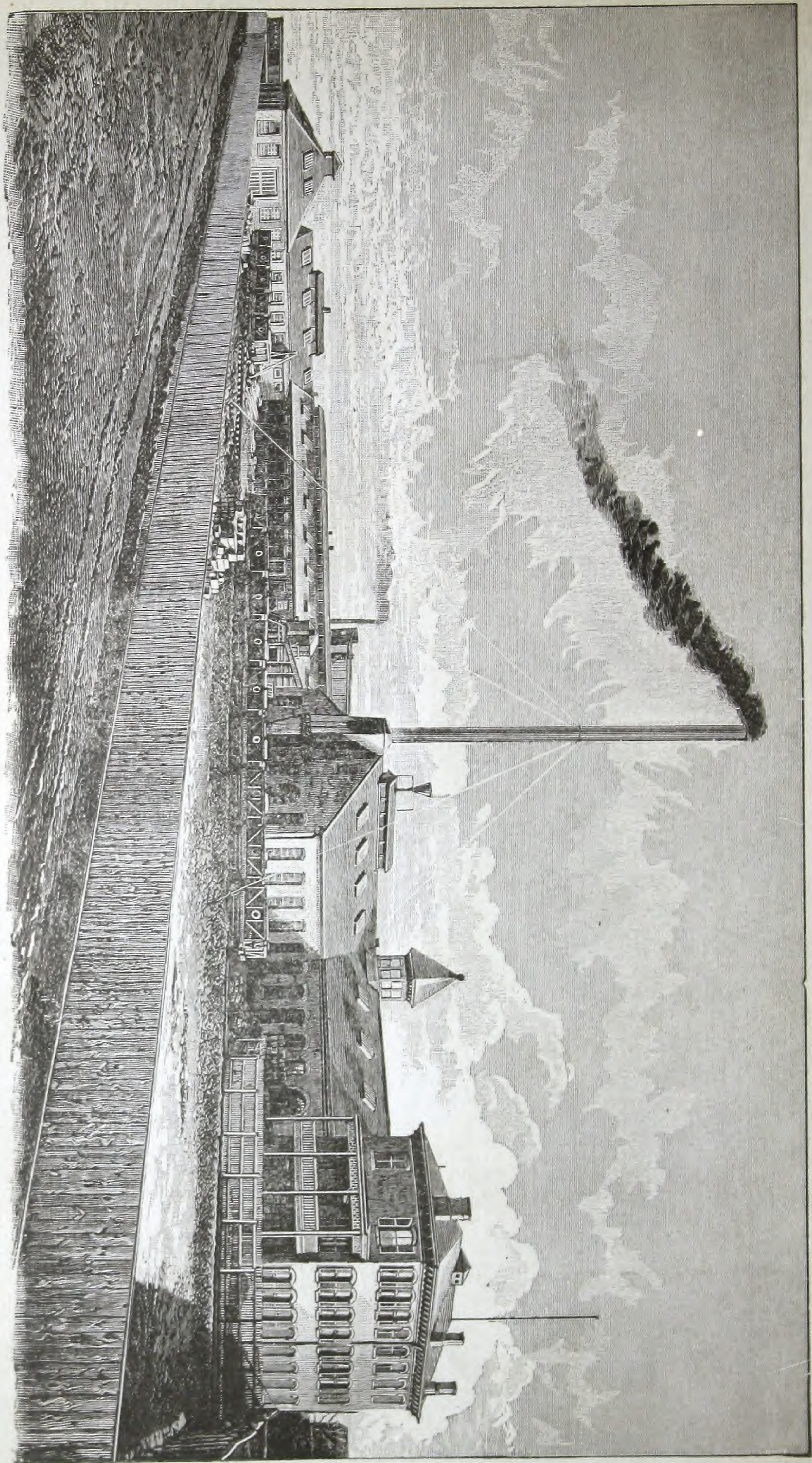
TYPE OF CELLS.	CHARGING CURRENT.		WORKING RATE AND CAPACITY.				EXTERNAL DIMENSIONS OF JARS.						WEIGHT OF ACID.		WEIGHT OF COMPLETE CELL.		HEIGHT OVER ALL, INCLUDING CONNECTIONS.
	Normal.	Maximum.	Normal.		Maximum.		GLASS.			RUBBER.			Glass.	Rubber.	Glass.	Rubber.	
			Rate.	Ampere Hours.	Rate.	Ampere Hours.	Length.	Width.	Height.	Length.	Width.	Height.					
15 A	30	40	30	300	40	250	11½	9	13⅜	12¼	9¾	13¾	31¼	19	121	120	21
7 B	13	18	13	150	20	120				8⅞	3¾	13⅞		8½		51	21
23 C	22	30	25	150	30	110	8¼	8	9¾	7¾	7⅝	9⅝	14¼	12	49¾	42¾	13¾
15 C	15	20	15	100	20	70	5½	8	9¾	5	7⅞	9⅝	9¾	7½	34¾	27⅞	13½
7 C	6	9	6	45	9	30	3⅞	8	9¾	2⅞	7½	9⅛	5¼	3¾	19¼	13⅛	13½
41 D	20	30	20	90	30	80	10⅝	5⅝	6⅞	9⅞	5	6⅞		7½		32	10¼
21 D	10	15	10	45	15	40	6⅞	5⅝	6⅞	5⅝	5	6⅞		3¾		16¾	10½
11 D	5	7	5	23	8	20	3⅞	5⅛	6⅝	3	4⅞	6⅛		2		8½	9
5 D	2	3	2	9	3	8	2⅛	5⅛	6⅝	1⅞	4⅞	6⅛		1		4⅛	8¼

Electro-motive force of each cell is about 2 Volts.











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CCA